

CQ

FEB., 1951

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The Radio Amateurs' Journal

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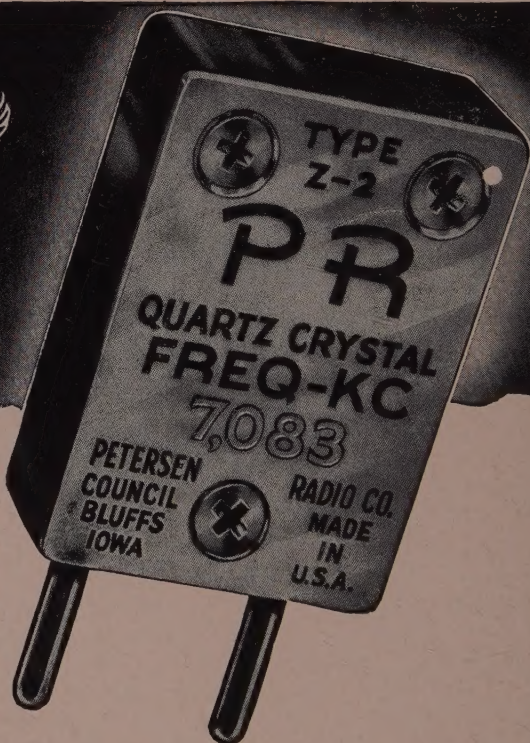
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PR

and **KNOW WHERE** you are!



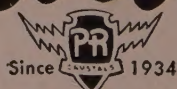
"Looks like you're out of the band, old man. Of course, my receiver may be off but according to my readings you're . . . etc." — "There's a CW sig on you . . . better check your frequency" — "I can't find you since you moved up, Bill. You said you'd move up 25 kaycees but can't hear you there" — "Sorry, Charlie, I am monitoring the spot set for our sked but no soap. Guess you must be on the wrong frequency." — How much of this kind of talk do you hear these days? Plenty. Unless you are CRYSTAL CONTROLLED you can never be sure where you are. Get set to enjoy yourself this winter. Pick PR Precision CRYSTALS at your jobber's and **KNOW WHERE YOU ARE!**



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Crystals



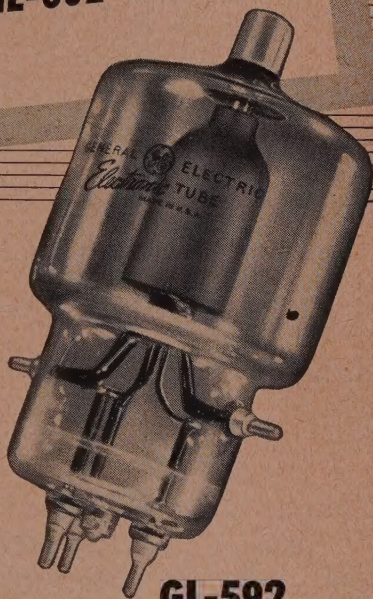
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Get it easily, get it cleanly
... with the GL-592 triode!



GL-592

Typical Operation, Class C
Telephony, ICAS

| | |
|--------------------------|---------|
| Filament voltage | 10 v |
| Filament current | 5 amp |
| Plate voltage | 2,800 v |
| current | 250 ma |
| input | 700 w |
| dissipation | 225 w |
| Frequency at max ratings | 150 mc |

ROBUST performance—a BIG signal that commands attention—these are one chapter of the GL-592 story. Here's a tube, usable up to 150 mc at full ratings, which will take 700 w phone input. A pair will handle a cool-as-January kilowatt.

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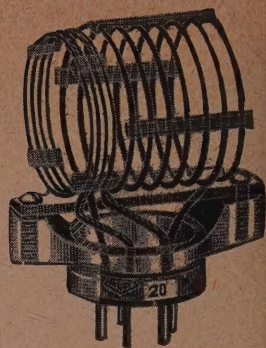
184-KA1

● As is true with other G-E modern h-f transmitting tubes (such as the GL-4D21/4-125A and GL-4-250A/5D22), the GL-592 attains its high watts-per-dollar value by taking advantage of a small amount of forced-air cooling. An ordinary 8" household fan, or a small furnace-type or other blower, is all you need.

the COIL that foils breakage

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with Polystyrene Plastic Base



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| Catalog No. Fixed End Link | Catalog No. Fixed Center Link | Catalog No. Adjustable Center Link | Catalog No. Adjustable End Link | Band | Capacity* | Dealer Cost |
|----------------------------------|-------------------------------------|--|---------------------------------------|-----------|-----------|----------------|
| ..... | ..... | OLS-160 | ..... | 160 Meter | 100 MMFD | \$2.28 |
| ..... | ..... | ..... | OES-160 | 160 Meter | 86 MMFD | 2.28 |
| OEL-80 | OCL-80 | OLS-80 | OES-80 | 80 Meter | 75 MMFD | 1.95 |
| OEL-40 | OCL-40 | OLS-40 | OES-40 | 40 Meter | 52 MMFD | 1.92 |
| OEL-20 | OCL-20 | OLS-20 | OES-20 | 20 Meter | 40 MMFD | 1.83 |
| OEL-15 | OCL-15 | OLS-15 | OES-15 | 15 Meter | 30 MMFD | 1.80 |
| OEL-10 | OCL-10 | OLS-10 | OES-10 | 10 Meter | 25 MMFD | 1.74 |
| OEL-6 | OCL-6 | ..... | ..... | 6 Meter | 17 MMFD | 1.41 |
| ..... | ..... | OCP-10 | OEP-10 | 10 Meter | 45 MMFD | 1.74 |
| ..... | ..... | OCP-20 | OEP-20 | 20 Meter | 50 MMFD | 1.83 |

* Denotes tube plus circuit plus tank plus output coupling capacity required to resonate coil at low frequency end of band.



• SHIELDED • COIL LINKS

These links are made to fit RLS, VLS, and MLS series of coils. This link will prevent capacity coupling between the tank coil and the link and would reduce TVI by greatly attenuating harmonics. The links can be used on co-ax or balanced lines.



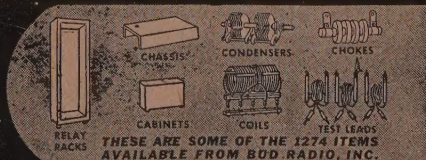
• ADD-A-LINK

When the circuit that you are using requires a different number of turns on the coil link than is furnished with the standard coil, the links listed below can be used to replace the standard link.

| Catalog Number | DESCRIPTION | Dealer Costs |
|----------------|--------------------------------|--------------|
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| AM-1301 | Used with VLS coils (500W) | 2.19 |
| AM-1302 | Used with MLS coils (Kilowatt) | 2.61 |

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| Cat. No. | Used With | No. of Turns | Dealer Cost |
|----------|-----------|--------------|-------------|
| AM-1303 | RLS | 3 1/2 | \$.52 |
| AM-1304 | RLS | 4 1/2 | .54 |
| AM-1305 | RLS | 5 1/2 | .63 |
| AM-1307 | VLS | 3 1/2 | .52 |
| AM-1308 | VLS | 4 1/2 | .54 |
| AM-1309 | VLS | 5 1/2 | .63 |
| AM-1310 | VLS | 6 1/2 | .72 |
| AM-1311 | MLS | 3 1/2 | .81 |
| AM-1312 | MLS | 4 1/2 | .96 |
| AM-1313 | MLS | 5 1/2 | 1.05 |
| AM-1314 | MLS | 6 1/2 | 1.14 |



BUD RADIO, INC.



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VOL. 7, NO. 2

CONTENTS

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The Radio Amateurs' Journal

35c

OUR COVER

When the winter DX starts to roll in at W4BRB, the 20 meter rotary comes off the mast and the 40 meter ground plane goes up. A horizontal dipole for 80 meters runs to another mast, and gets a workout the year 'round. See page 20 for the story on W4BRB's specialty - 80 meter DX.

| | |
|--|----|
| Scratchi | 4 |
| Letters | 6 |
| Zero Bias | 11 |
| A TVI-Proof 10-Meter Exciter John F. Clemens, W9ERN | 13 |
| Radio Wave Propagation Chester R. Underhill, W2YT | 17 |
| DX A La 3.5 MC Gene B. Sykes, W4BRB | 20 |
| The Monitoring Post | 23 |
| The Heteronull Clarence A. West, W2IYG | 24 |
| DX & Overseas News | 27 |
| WAZ Honor Roll | 30 |
| The Versatile Vertical Carl Weidenhammer, W1ZL | 31 |
| The Auto Call R. V. Anderson, W3NL | 33 |
| The YL's Frequency | 36 |
| V.H.F. - U.H.F. | 38 |
| Seedrick's Sendin' Station W. W. Purvis, W2BK | 42 |
| Hams Aid in Korean Crisis | 52 |
| Classified Ads | 62 |
| Advertising Index | 64 |

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Feenix, Ari

Deer Hon. Ed:

Scratchi are about to having big hee-haw radio expert from California, who are coming over to telling me why something can't work. The big hee-haw is on acct. it is still working, although not even Scratchi himself are figuring out how to come. But I are getting the horse ahead of the story, so I better backing up and starting from scratch.

Several weeks ago I deciding to ride around Brother Itchi's ranch, to getting acquainted with its farthest away parts, so I saddling up nice gentle horse, packing a lunch, and taking along my battery-powered BC set. Reason for taking latter item is not only so can hear cupple favorite soap operas, but also if Brother Itchi wantin me he can turning my rig on (which are covering hole BC band like a tent) and calling me in case of emergency.

I are spending most of day riding around dodging cactus, keeping out of sun by stayin under shade of big hat I wearing, and are even finding small tree to having lunch under, which are sharing with one gopher and several lizard. Later in afternoon are turning radio on for programs, and continuing ride. First thing I knowin are finding that radio programs getting louder and louder. I keep turning down volume control and finally have it turned all the way back, but stations are booming in like nobodies business. This are making Scratchi most curious, so am doing some investigating.

By riding around are finding that in one spot all radio stations, even those from California, are coming in so loud that the speaker cone are in danger of being broken. Even when opening switch and disconnecting antenna, stations still so loud they distorting and everything.

Riding back to ranch, Scratchi get to thinkin and by time arriving home for dinner, plans are all made. Next morning I getting into jeep, after loading it with lots of radio equipment, and quick driving out to my magic place. Using emergency power gas generator are firing up my regular receiver and are finding that battery receiver are telling the truth — the signals are fantastic loud. So, next are driving sticks of wood in ground, and running lots of wire around. First thing you know I have about five antennas strung around the desert, all in place where real loud signals are coming in.

Each antenna are a certain length, as are making them half-wave long on frequency of a certain broadcast station. Now I should be havin

(Continued on page 5)

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| 116U, 7.5 amps, panel mtg. | 18.00 |
| 1126, 15 amps | 46.00 |
| 1156, 45 amps | 118.00 |

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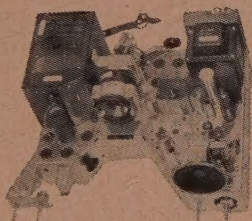
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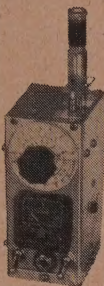
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| Kit form | \$24.95; |
| Wired and tested | \$29.95 |

NOTE: In view of the rapidly changing price situation in both complete units and components we wish to emphasize that all prices are subject to change without notice, and are Net, F.O.B., N.Y.C.

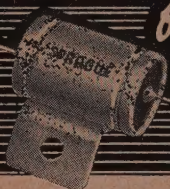
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|----------------|------|-----------------|------------------------|------------|
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| 47P12† | .005 | 1000 d-c | 7/16 x 1 1/4 | 2.40 |
| 47P13† | .01 | 1000 d-c | 7/16 x 1 1/2 | 2.60 |
| 47P14† | .005 | 2500 d-c | 1 x 1 9/16 | 2.90 |
| 47P15† | .01 | 2500 d-c | 1 x 1 9/16 | 3.10 |
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*Recommended for power lines, filaments, and control circuits up to 20 amps line current. Often more effective than a choke-capacitor filter. Has female screw terminals.

†Circulating current to ground at 14 and 28 mc should not exceed 2 amps for 47P15 and 47P16, 3 amps for 47P13 and 47P14, 4 amps for 47P12.

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NORTH ADAMS

MASSACHUSETTS

★ ★ Letters ★ ★

Bread Cast on the Waters?

The General Theological Seminar
Chelsea Sq., New York 11, N.Y.

Editor, CQ:

A few months ago, I was looking over my "extra parts" shelves, and an idea occurred to me. Most of this material I would never use. All kind of junk, old magazines, ancient power transformer call books from 1947, '48 and '49. Was there, somewhere, a ham who was in need, who would put this stuff to good use? In the June (or was it July?) 1950 "CQ" I ran an ad: Used magazine and Call Books to any DX willing to pay the postage costs.

I wish you could have seen the letters I got. You wouldn't believe it. They came from all corners of the globe, from nearly every continent. They asked all kinds of questions: for Call Books swap magazines, CQ and QST; for old chassis for war surplus. They did everything but ask for OIA's by number.

I had no idea there was such need, such dollar shortage, over there. I sent all I had and some good stuff besides. And the letters and gifts that came back were something to touch the hardest heart.

It occurred to me that there must be other ham with idle gear. Wouldn't you like to lend a hand to a guy who was really trying hard to get along with ten watts to PP 47's? Call it investment in DX QSL's, call it investment in international friendship, charge it up to the ham fraternity, call it anything you like, but if you really want to do a good deed and lend a hand to some sweet Joes, try giving away some of that gear you're not using right now. It has occurred to me that perhaps some club would be willing to set up an agency where old gear and books could be donated to be forwarded on request to DX hams. What say, OM's?

Charles L. Wood, W2VMX

On the BC-221

151 8th Ave., NYC 1

Editor, CQ:

In the December issue, there are some mild misconceptions in the piece on measuring frequency with the BC-221. So far, I haven't seen one of them that actually has "2.5 dial divisions per kc." I have calibrated one of mine rather carefully using high harmonics in the 20 to 30 mc band against a frequency standard and multi-vibrator unit, checked and monitored against WWV. From 3950 kc to 4000, mine runs 2.094 divisions per kc. Call that 2.1, and each tenth of a division is just a mite shy of being 46 cycles, instead of the 40 mentioned in the article. When using the eighth harmonic, this can run into quite an error, if fellow happens onto a setting well removed from a calibration point.

Even at 3500 to 3550 kc, this one only runs 2.1 divisions per kc, which we can call 2.16 without causing a tremor to shudder the foundation of the Bureau of Standards. Actually, the BC-221s I have shaken hands with show a fairly smooth taper from almost exactly 2.5 divisions per kc at 2000 kc, to about 2.1 divisions per kc at 4000 kc.

(Continued on page 4)

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- ☐ NC-57 Info C-2
☐ NC-183 Info
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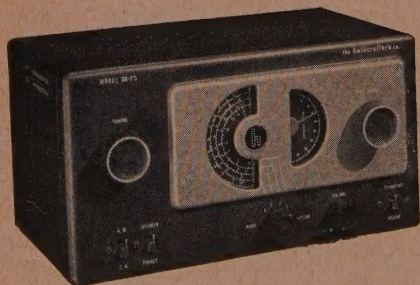
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Most compact flexible unit of its type ever offered. Ideal for semi-portable or emergency use—for vacations or for new amateurs. A complete one-package station.

10 Watt input crystal controlled transmitter 80, 40, 20, or 11/10 Meters. Pi network output for matching wide range of antenna impedances. Built in keying relay. Socket for plate meter.

Receiver substantially same as famous S-38B. Transmitting section uses separate crystal oscillator plus receiver output tube.

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Hallicrafters precision instruments have been sold in 89 countries, used by 33 governments. They are remembered by veterans, prized by experts, and preferred by radio amateurs throughout the world who want a radio that is all radio.



S-76 \$169.50

**NEW DUAL-CONVERSION RECEIVER
WITH 50-KC I-F**

You've read about it, you've heard about it, now here it is—with the most wanted features, at the lowest possible price.

DUAL CONVERSION (1650 Kc and 50 Kc)—more usable selectivity than the best crystal.

GIANT 4-in. "S" METER—calibrated in microvolts and "S" units.

OTHER FEATURES: Four bands 538-1580 Kc, 1720 Kc to 32 Mc. Calibrated electrical bandspread. 5 position selectivity. Sensitivity 2 microvolts or better with 5 watt output. 9 tubes plus regulator, rectifier.

hallicrafters

"The Radio Man's Radio"

Eimac
TUBES

THESE ARE THE TUBES OF CHAMPIONS
... THE FIRST CHOICE OF LEADING
AMATEURS EVERYWHERE. THEY PROVIDE
MORE WATTS PER DOLLAR COST AND
THE UTMOST IN DEFENDABILITY AND
PERFORMANCE.

COMPLETE TUBE DATA AVAILABLE FREE

4-125A The tube that made transmitting screen-grid tubes popular. The 4-125A will take a plate input of 500 watts for CW or 380 watts for phone. Driving power is less than 2 watts. A pair of these tubes makes an ideal high-power phone or CW final.



4-250A A pair of 4-250A tetrodes will easily handle a KW for phone. In CW service, one tube will take a KW input. Driving power is only 2 to 3 watts per tube. As modulators, a pair will deliver as much as 750 watts of audio with zero driving power.



4-400A For really deluxe equipment use the 4-400A tetrode. One tube can be run at a KW input for CW or 880 watts for phone. Low drive, too, of course, less than 5 watts. Available as an accessory is an air-system socket for simplified cooling.



4X150A For VHF or UHF work, use the 4X150A. This small, forced-air cooled external anode tetrode will handle 250 watts input on the ultra-highs with a driving power of but a few watts. The 4X150A operates well on plate voltages as low as 400 or 500 volts, making it ideal for portable or mobile equipment with a wallop.

100T The "old reliable" 100T, improved throughout the years, is still top choice of amateurs who prefer a triode. Will take a plate input of 500 watts for CW or 350 watts for phone. As modulators, a pair will deliver 420 watts of audio.



250T A tried, proven, and continually improved 250-watt triode. The ideal triode for 1 KW CW input. Will handle 825 watts input on phone. With plate voltage as low as 1500 volts, a pair will modulate all the law allows.



VVC60-20 This is but one type in the Eimac line of variable and fixed vacuum capacitors for plate tank circuits. The VVC60-20 is variable over a range of 10 mmfd to 60 mmfd. Maximum r-f voltage is 20 kv.

EITEL-McCULLOUGH, INC.

San Bruno, California

1001 Market Street, San Bruno, California

ZERO BIAS

E D I T O R I A L

FLASH!

FCC Announces Amateur Frequencies Reserved for Civil Defense Communications

On January 17, the FCC announced that the following frequencies have been exempted from possible military use, and will be retained specifically for amateur emergency communications if circumstances require release of amateur frequencies to the Armed Forces:

Present bands between 1800 and 2000 kc.
3500 to 3510 kc, and 3990 to 4000 kc.
28.55 to 28.75 mc., and 29.45 to 29.65 mc.
50.35 to 50.75 mc., and 53.35 to 53.75 mc
145.17 to 145.71 mc., and 146.79 to 147.33 mc.
220 to 225 mc.

This notice does not affect present amateur regulations. It is intended as a guide for Civil Defense planning, and as such serves immediately to end much of the present confusion. It certifies our place in the Civil Defense picture, and squashes such rumors as "the Air Force is sure to take the entire 2 meter band," etc. Since it is intended solely as a planning guide, it does not cover the circumstances under which these frequencies may be used and does not discuss the possibility of routine QSO's on any of these frequencies.

Our recent editorials on radiation of 15.75 kc. harmonics from TV sets has resulted in more reader correspondence than we can handle. Since

the problem seems to be so widespread, it looks like a good idea to list some initial findings here, rather than hold things up until an article can be prepared.

Several manufacturers have traced the effect (in their models) to coupling through the heater supply, through which the interference reaches the AC line. In production, the cure is proper heater by-passing; the obvious remedy for such a set already in service is a line filter.

ITV also can and does occur due to coupling between the TV receiver antenna and a poorly shielded deflection system. A high-pass filter in the receiver antenna line usually is a definite help in such cases. (This is a setup for Scratchi. Can't you see him running super power to overload his neighbor's TV sets, to force them to add high pass filters to cut down the ITV he gets from them?!)

Nostalgia

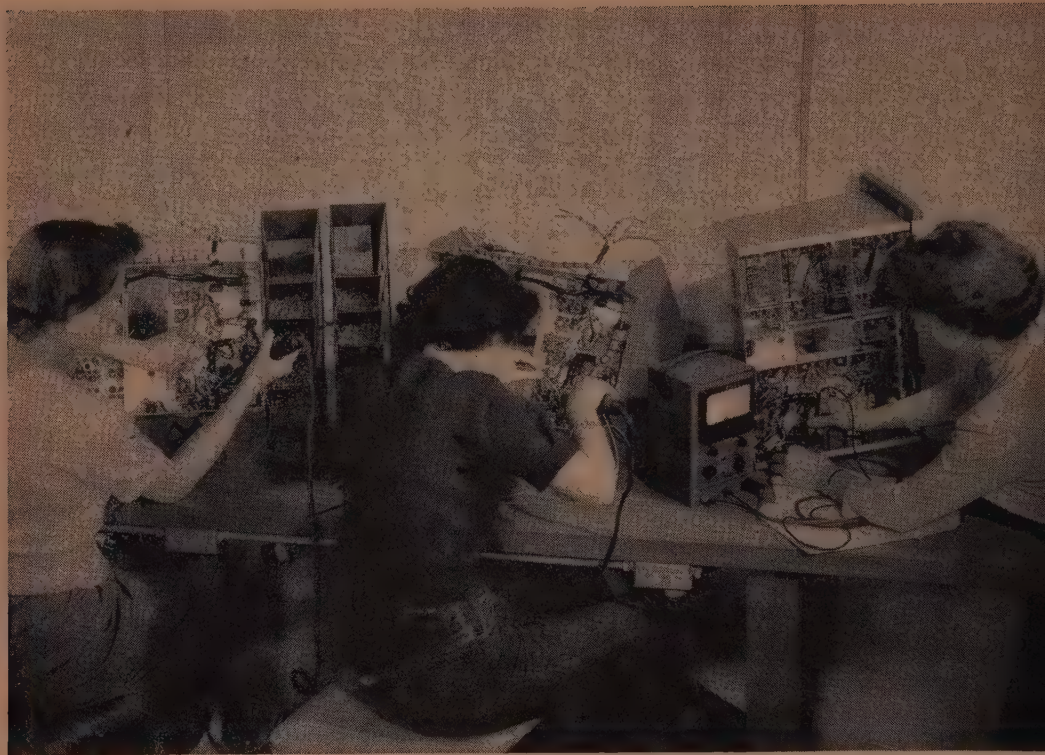
Them as longs for the good old days of ham radio have a chance to sample some of the old time flavor via the 160 meter DX tests now being conducted by G6FO and W1BB. These tests are run on alternate Sunday mornings until the middle of March, between the hours of 0500 and 0800 GMT. This is being written before the first test period, but the Trans-Atlantic path has already been broken down by EK1AO and a number of G's. EK1AO was S6 to 7 on the East Coast on January 7, and on the same morning G6GM worked as far inland as W8 and was heard in W9. Signals peak up just before sun-up on the other side; even if you're not transmitting in the tests, you might take a listen to get an idea of what it might have been like in the 200 meter days.

Oops - - - Sorry!

It's nice to be made aware of the eagerness with which the gang awaits CQ, but being late with an issue is an embarrassing way to find it out.

What happened is that the railway strike, the usual holiday shut-downs and present procurement difficulties combined to prevent delivery of our usual paper supply. As a result, we ran out of paper early during our run, and consequently lost our turn on the presses. It's a goshawful feeling, and we hope we never get caught like this again.

—Gene, W2ESO



The best final test of all

Early last November a limited run of 75A-2 receivers went through the planned procedures for assembly, inspection, test, packaging, and shipment to distributors for delivery to amateurs.

Production was then temporarily halted, to await the findings of the most revealing final test a receiver can have — for the condition in which it was received, and its operation in the hands of customers.

Minor bugs were uncovered, and have been eliminated for present and future owners.

The assembly line rolls again in January, 1951, and will be in full production in February.

You who have ordered will soon have your Collins 75A-2's.

FOR THE BEST IN AMATEUR RADIO, IT'S . . .



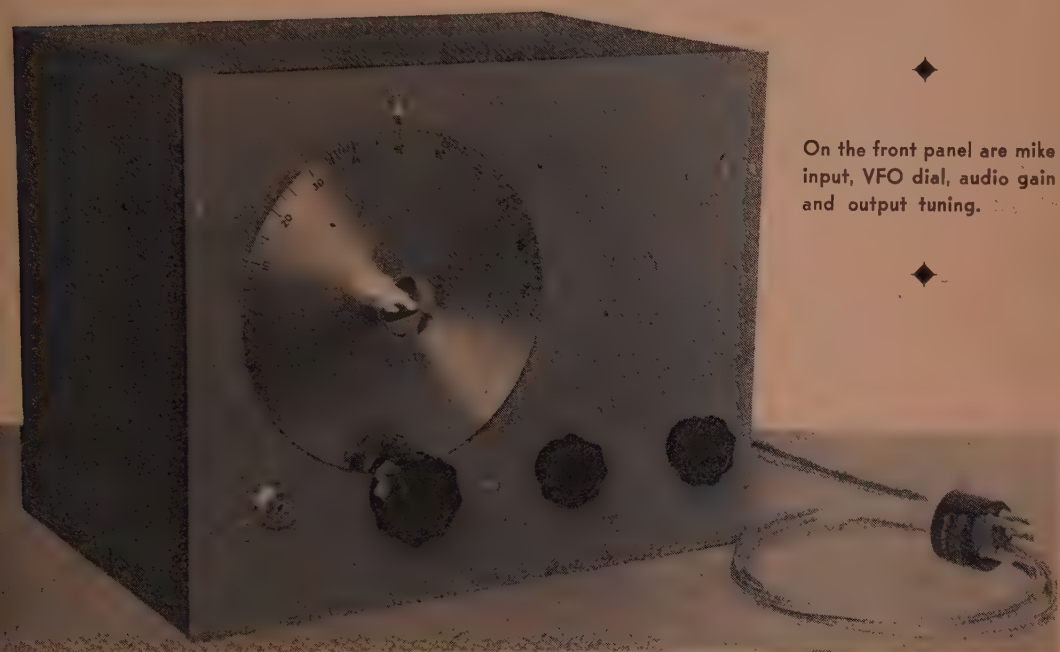
COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 West 42nd Street, NEW YORK 18

2700 West Olive Avenue, BURBANK

A T V I - P R O O F 10 M E T E R E X C I T E R

JOHN F. CLEMENS, W9ERN*



On the front panel are mike input, VFO dial, audio gain and output tuning.

The Second Place Winner in CQ's Prize Contest, W9ERN's exciter features operation of the oscillator on the 10-meter band, to simplify TVI problems.

FOREMOST AMONG THE PROBLEMS which challenge the advance of the art of amateur radio is the elimination of interference to television broadcasting. Unfortunately, the eye is not so tolerant with respect to interference and an extremely small amount of interference will seriously degrade television reception. Amateur transmitters which are well-behaved in other respects are almost universally guilty of objectionable radiations unless special precautions have been taken in their construction. A near revolution in transmitter design is being forced upon hams in the attempt to eliminate TVI, but the new high standards are not entirely without reward to the amateur. This is true because measures taken to reduce TVI are of benefit to the quality of the transmitted signal. For instance, an antenna system which reduces

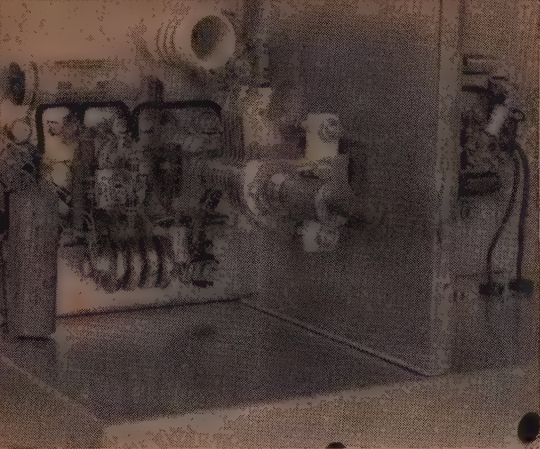
TVI by eliminating transmission line radiation also puts all of the available power into the antenna where it will be most effective for communication.

The principle objective in the design of the exciter to be described was freedom from TVI and BCI. To approach this problem, the interference situation must be analyzed and each type of interference eliminated.

TVI Considerations

All TVI cases and most BCI cases can be put into one or more of the following categories: 1) Harmonic radiation from the transmitter which falls into a television channel; 2) Intermediate-frequency amplifier interference occurring where a harmonic of the transmitter falls in the receiver I.F. channel, usually near 21 MC; 3) Fundamental transmitter signal overloading the TV

*612 College Hwy., Evansville, Ind.



Inside Oscillator Compartment: The VFO tuning condenser frame is insulated from ground except for a single wire which grounds the rotor to the rear wall to prevent the flow of tank current in the shield.

receiver; 4) Direct pickup in the video amplifier or the receiver which is sensitive to signals up to about 4 MC.; 5) Generation of spurious signals in the TV channel due to transmitter exciting a non-linear conductor near the TV antenna; 6) R. F. pickup and rectification in the receiver audio circuits. This last item is the cause of a common BCI situation where 10-meter AM phone signals are heard across the entire dial of a conventional AC-DC midget receiver.

Only the first two of these categories are caused by malfunction in the transmitter, but it is nevertheless possible to suppress some of the other types of interference at the transmitter.

To deal with each of the above types of interference the following measures are effective, respectively:

- 1) Reduction of harmonic generation by operation of transmitter stages class A. Use of low-pass filters. Complete shielding.
- 2) Reduction of harmonics which fall near 21 MC by steps above or by a shift of the fundamental frequency, e.g., to ten meters.
- 3) High pass filter at the TV receiver antenna terminals.
- 4) Removal of all modulated components from the 160 and 80 meter bands. Use of SSSC.
- 5) Eliminate the non-linear element. If this is not possible, reposition the transmitting and/or TV antenna.
- 6) Use of FM rather than AM. These points have been followed in the equipment pictured and all details will be given. The results have been well worth the effort involved. All succeeding power amplifiers must be likewise treated to realize the benefits of TVI-proofing the exciter.

Circuitry and Construction

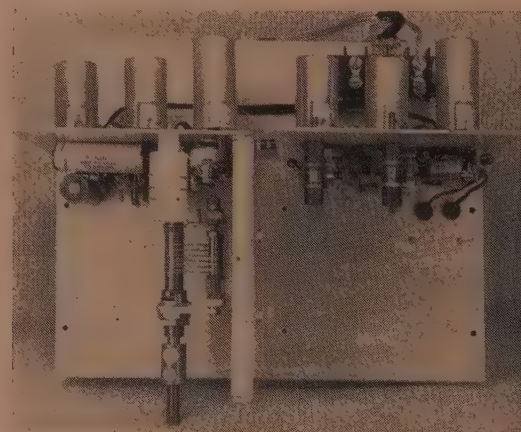
The most radical departure from conventional design is the complete absence of frequency multipliers in the exciter. The unit is strictly a one-band piece of equipment for 10 meters; similar units for other bands are planned and partially

completed. This system of providing a separate exciter for each band has certain advantages. For instance, a 40 meter exciter can include special keying and break-in circuits, while the 80 meter exciter may include SSSC. The investment in each exciter need not be great, especially since a common power supply may be used.

The elimination of frequency multipliers makes possible the operation of all exciter stages as low-distortion class A amplifiers and thereby tremendously reduces harmonic generation. Also, since the VFO operates on the 30 MC band, the harmonic frequencies are widely spaced so that there is no possibility of TVI in a channel not some multiple of the transmitter output frequency. This same feature prevents interference of the types in the second and third categories above since no frequencies are generated in the spectrum below 30 MC.

Double shielding of all the exciter circuits is accomplished by enclosing the wiring inside either of the two compartments above the chassis or under the chassis and then mounting the entire unit inside a standard 7x8x10 utility box. The 7x9x2 aluminum chassis has a bottom cover of aluminum. The power cable is shielded and coax cable is used for the output.

Filters are used in all the power leads into the exciter compartments. The combination of shielding and filtering not only prevents harmonic radiation but also enhances the frequency stability. Note that the two compartments, one containing the audio and oscillator circuits, and the other the three r.f. amplifier stages, are completely separate. A common wall or baffle between two compartments should be avoided for minimum interstage coupling. In the output coax line, an m-derived low pass filter is installed. This filter has a cutoff frequency of 36 MC and a frequency of maximum attenuation of 58 MC. It was necessary to depart slightly from the calculated values of capacity in the filter to use standard components; the principle effect of this change is to modify slightly the input im-



Top View:

The circuit progresses from speech amplifier on the left to power output stage on the right.

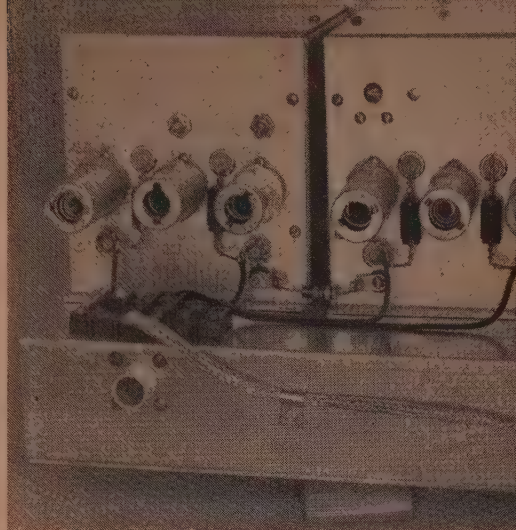
Back View:

Power is carried into the two compartments by the mica button feethrough condensers.

pedance looking into the filter when it is terminated in 52 ohms. Setting the frequency of maximum attenuation at 58 MC gives excellent suppression of the second harmonic.

FM is used to prevent the sixth type of interference, namely, rectification of r.f. by the audio circuits of a receiver. Since the exciter output is entirely free of amplitude variations, no audio output can occur if r.f. is rectified in a receiver.

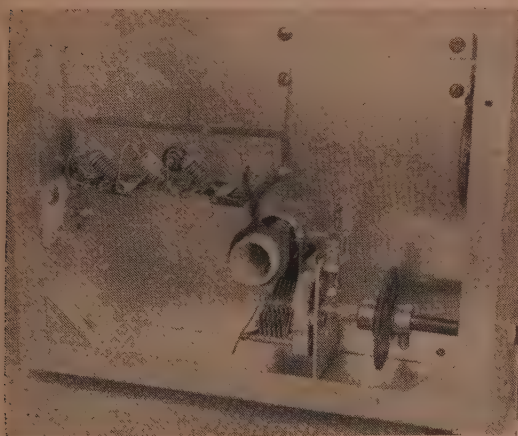
The oscillator, operating on the output frequency, uses the TNT circuit. This type of oscillator was chosen over several other circuits tested as the best choice for this particular application. The cathode operates at ground potential, so there is no frequency drift due to a varying heater-to-cathode capacity. The frequency range and feedback adjustments are independent so the task of determining the proper feedback tap on a coil has been eliminated. The plate coil and condenser control the frequency range and the grid choke determines the feedback. It should be noticed that the usual connections of grid leak and grid choke are reversed with the grid leak being in the ground return of the grid coil. The output voltage is then taken from across the grid condenser. Since this capacity shunts the output, harmonics of the oscillator are attenuated. In the usual arrangement, where output is taken from across an inductance, there is a high impedance to harmonic voltages across the output terminals. With the system in use, the output voltage is quite low, yet additional attenuation is still necessary to prevent over-driving the following amplifiers. The oscillator voltage output is taken out of the oscillator compartment by means of a 1 uuf condenser which connects to the output terminal. The voltage is brought into the amplifier compartment via a similar feed-through grommet with a 3.9 K resistor connecting the two terminals. The amplifier input terminal is



then shunted to ground through 1000 ohms. The coupling resistor, 3.9 K, was selected by increasing its value until the output of the exciter began to drop. This prevents limiting and attendant harmonic generation in the amplifier stages. All grounds in the oscillator compartment are made to the rear wall of the compartment on which the tubes are mounted. The variable condenser rotor is also grounded at this point, to prevent the flow of the circulating oscillator tank current in the shield walls. The tuning condenser is mounted on a piece of bakelite on one of the side walls and a wire grounds the rotor to the rear wall. A trimmer condenser for setting the frequency range of the oscillator to the proper value of 26.9 to 29.9 MC is accessible through a small hole in the rear wall, just above the oscillator tube.

In the amplifier compartment, the two 6AK5 voltage amplifiers are slug-tuned, also from the rear, while the power output stage is condenser tuned by a control on the front panel. The slug-tuned stages are sufficiently broad that the output of the 6AK6 is within 1 db of 1.25 watts over the entire band. The broad response of the 6AK5 stages is in part due to the resistance loading across each slug-tuned coil which limits the amplification per stage to approximately 25. As a further measure of isolation, a simple series resonant circuit is used to couple between each of the amplifier stages. The self-supporting coils are first resonated at 29 MC with the 30 mme. coupling condensers by means of a grid-dip meter or use as a wavetrapp in a receiver antenna lead, and then re-connected as series circuits in the exciter.

Both the 6AK5 and 6AK6 stages are neutralized to prevent self-oscillation and reduce variations reflected from plate to grid of each stage which might affect the oscillator stability. The neutralization scheme has been used with good results in stabilizing FM receiver I.F. stages.^{1,2} Briefly, the



Under Chassis View: The m-derived output filter greatly attenuates harmonics. The angle of the coils on the tie strip produces minimum mutual coupling.

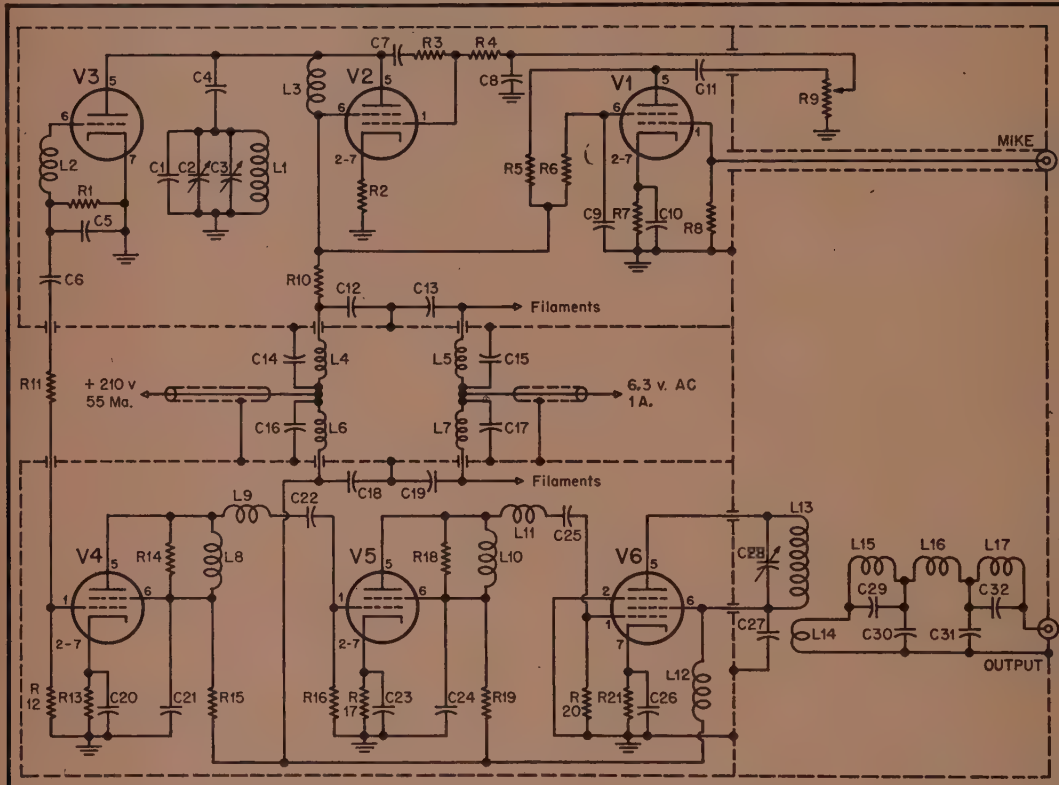
¹ G. E. Gustafson & John L. Rennick "Low Cost FM-AM Receiver Circuits," Tele-Tech, October 1948, p. 36
² CQ, July, 1949, p. 44

system consists of balancing a bridge circuit so that voltage between plate and screen does not appear between grid and ground. The bypass condenser from screen to ground is adjusted to balance the bridge circuit which also includes the grid-to-plate, plate-to-ground, and grid-to-screen tube capacities. This neutralizing capacity was determined experimentally as 150 uuf for a 6AK5 and slightly more for a 6AK6. The value is not critical and standard fixed condensers may be used. Note that to use this system, the plate return must be con-

nected to the screen for rf. The resistors which supply the plate and screen current to the 6AK5 stages are required to decouple the screen from ground to take advantage of the neutralization scheme, as well as to drop the regulated 210 volt supply to the proper 150 volts for a 6AK5.

The output tank coil and coaxial filter are mounted underneath the chassis. The coaxial filter is assembled on a tie strip which is mounted on a narrow metal plate which forms the ground side

(Continued on page 5)



- C1 100 μ f zero temp ceramic
- C2 3-12 NPO trimmer
- C3 35 μ f variable
- C4 500 μ f zero temp ceramic
- C5 C8 C22 C25 30 μ f ceramic or mica
- C6 1 μ f ceramic or mica
- C7 5 μ f ceramic or mica
- C9 .01 μ f.
- C10 25 volt, 10 μ f. elect.
- C11 .005 μ f.
- C12 C13 C18 C19 1000 μ f mica feed-through disc
- C14 C15 C16 C17 1000 μ f mica stand-off disc
- C20 C23 C26 .001 μ f.

- C21 C24 150 μ f ceramic or mica
- C27 500 μ f mica
- C28 50 μ f variable
- C29 C32 50 μ f ceramic
- C30 C31 100 μ f ceramic
- L1 3 turns #22 11/16 dia., 5/8 long
- L2 40 turns #28 closewound on 1w. (7/32" dia.) 1M. resistor
- L3 2.5 mh r.f. choke
- L4 L5 L6 L7 20 turns #22 closewound on 2 w. (5/16" dia.) 1M. resistor
- L8 L10 17 turns #28 enameled close-

- wound on 3/8" dia. form with powdered iron tuning slug (Cambridge Thermionic Corp. type L5-3)
- L9 L11 20 turns #22 closewound 1/4" dia., self-supporting. Resonate with C22 & C25 at 29 Mc.
- L12 40 turns #28 on 2w. (5/16" dia.) 1M. resistor
- L13 10 turns #22 enameled on 11/16" dia. form, 5/8 long
- L14 2 turn #22 hook-up wire link.
- L15 L17 8 turns #22 on

- 7/32 dia ceramic cond. (C29 & C32)
- L16 11 turns #22 on 1 w. (7/32" dia.) 1 M. resistor
- R1 27 K 1/2w.
- R2 R13 R17 330 1/2w.
- R3 10 K 1/2w.
- R4 100K 1/2w.
- R5 470K 1/2w.
- R6 1 M. 1/2w.
- R7 R11 3.9K 1/2w.
- R8 5M 1/2w.
- R9 1 M. Pot.
- R10 2.2K 2W.
- R12 1K 1/2w.
- R14 R15 R18 R19 4.7 1/2w.
- R16 R20 47K 1/2w.
- R21 470 1w.
- V1 V2 V4 V5 6AK5
- V3 664
- V6 6AK6

RADIO WAVE PROPAGATION

CHESTER R. UNDERHILL, W2YT*

Concluding a three-part article giving the authoritative low-down on why our high frequencies act as they do.

IN Part I and Part II of this series, which appeared in the Dec. and Jan. issues of *CQ*, the various mechanism of transmission which may be involved in working DX on our v.h.f. bands were discussed. Part I dealt primarily with ionospheric phenomena. Part II described the various departures from the "normal" atmosphere which might produce extended-range contacts. The third and final article of this series, which follows, elaborates on the considerations touched upon in Part II, and offers suggestions as to how v.h.f. tropospheric "band openings" may be predicted.

The weather patterns responsible for non-standard atmospheric conditions that form over the continental United States may be due to any one of several discrete meteorological conditions arising in the troposphere, or possibly a temporary combination of them. The three most common types of inversions that affect v.h.f. propagation are known as Nocturnal, Dynamic and Subsidence. It may be of interest to discuss each type in some detail, as amateur textbooks seem prone to skim over them rather lightly, leaving much to the imagination. Parenthetically, any amateur seriously interested in v.h.f. propagation via the troposphere would be well repaid by visiting his local library and procuring a text book on elementary meteorology. He will find the content interesting and it will yield him a basic knowledge of the dynamic physics of the troposphere that will be of great

aid to him in his understanding of v.h.f. propagation phenomena.

Nocturnal inversions are due to the heating of the earth's surface by infra red solar radiation during the daylight hours and the re-radiation, or loss of this heat energy after sunset. The cycle may be visualized as follows: During the daylight hours the earth absorbs infra red radiation from the sun which heats its surface. The air in contact with the earth is gradually heated during the day by convection to a height of several hundred feet. After sunset the process reverses; the earth's surface is rapidly cooled by infra red re-radiation. The warm air in contact with the earth is, therefore, also cooled and during the course of time gradually cools the air above it by convection to an increasing height. This condition, of course, constitutes an inversion (temperature rising with height) starting at the earth's surface at sunset and reaching to a height of several hundred feet as the night wears on. The height of the inversion varies the location of the tangent ray and thus determines the distance that VHF signals may be propagated by this type of inversion. This frequently extends from 150 to 300 miles.

Steep gradient changes in the index of refraction at the boundary of the air masses involved in nocturnal inversions also create the so-called surface ducts or natural "wave guides" as previously described. Over certain tropical ocean areas, surface "ducting" at UHF persists as long as the covering air mass is undisturbed by meteorological frontal action. As pointed out, the height or thickness of the inversion limits the frequency that may be horizontally propagated. The higher the "duct", the lower the frequency.

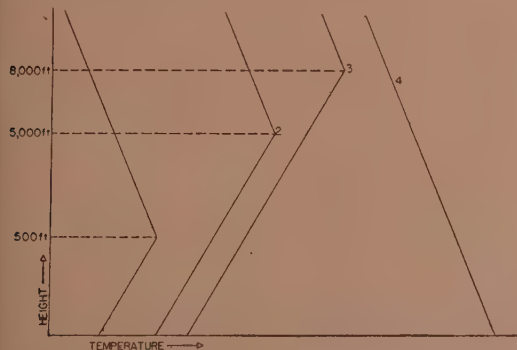


Fig. 7. Family of Temperature vs. Height plots showing three inversion types. 1)-Nocturnal or surface. 2)-Dynamic or advective. 3)-Subsidence. 4)-Standard atmospheric condition (no inversion)

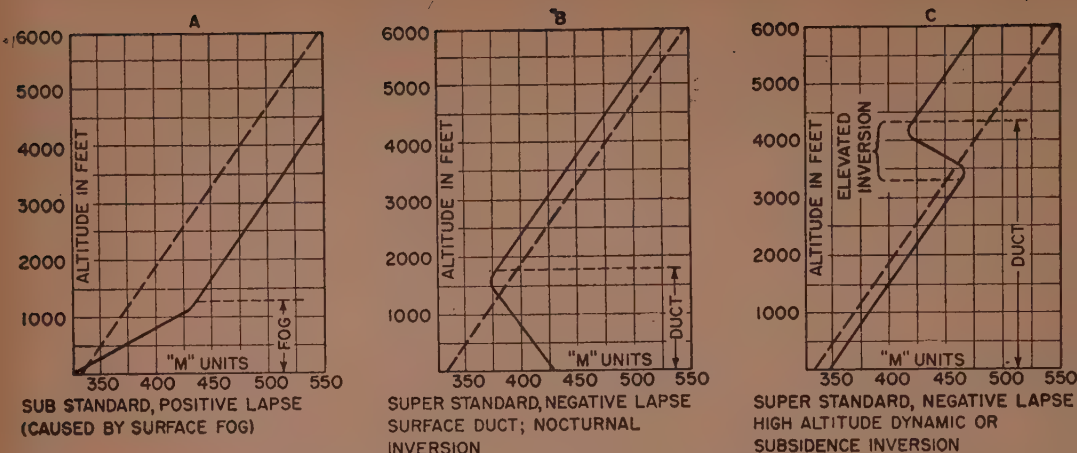


Fig. 8. Family of M curves showing inversion effect. The slope of the broken line in drawings indicates standard atmospheric condition with M units increasing linearly with height. When the slope of the M curve is less than the standard slope it is considered "sub standard," and the slope and lapse rate positive. When greater than standard it is considered "super standard," and the slope and lapse rate negative.

Dynamic inversions are caused by warm air masses over-running cold, or a cold front coming in under a warm air mass. Horizontal movement of air is known as "advection" and dynamic inversions are, therefore, sometimes referred to as "advective type". This type of inversion occurs at relatively high altitude, in the order of two to ten thousand feet, and results in about the only "predictable" type of VHF band opening. The advection of the warm dry air, occasionally formed over the arid Western plains regions in summer, may at times be charted and its probable course plotted a few days in advance.

Subsidence inversions take their name from the "subsiding" or falling of air toward the earth from the dome of a high pressure area due to compression. Air, like other gases, rises in temperature adiabatically when compressed. "Adiabatic" simply denotes a change in temperature without the addition or loss of heat. Now we know that when air rises in temperature, it is able to hold a proportionally greater amount of moisture. In other words, its *relative humidity* decreases as it becomes progressively "drier". When this falling warm dry air mass reaches the upper surface of the cool moist air adjacent to the earth's surface, a discontinuity of refractive index results.

Like the advective type of inversions, subsidence inversions usually occur at relatively high altitude, and thus lend themselves readily to VHF DX. However, as they are frequently associated with the falling away, or dispersing, of a high pressure area towards a low pressure area, it is impossible to forecast the elevation at which the discontinuity boundary will be likely to form. Best DX conditions, however, have been noted when the intervening air masses along the propagation path are undisturbed by the frontal turbulences associated with low pressure areas.

Another type of inversion, occasionally reported by aviators, is caused by convection heating of the air above cloud masses that have been heated by solar radiation. This is usually a duct forming type of inversion, probably not more than a hundred feet or so thick and effective only in the radar micro wave spectrum.

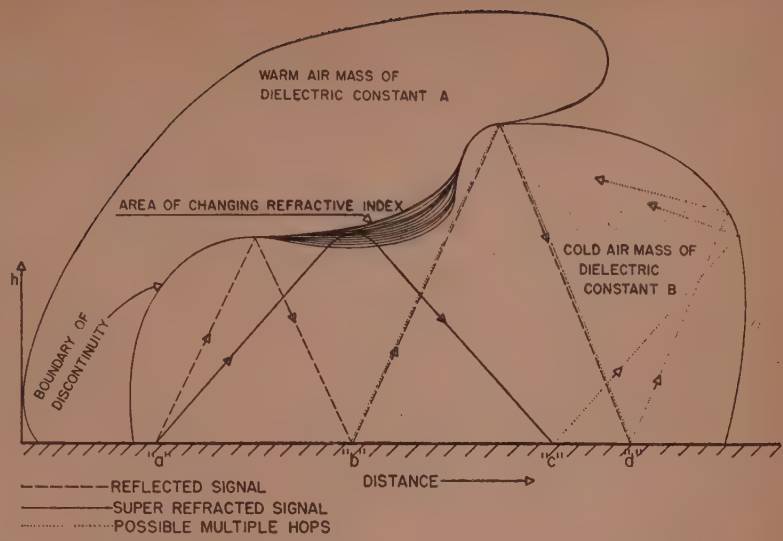
Fig. 7 shows a family of temperature plots and inversion boundaries for the three major types of temperature inversions discussed. As previously noted, dynamic and subsidence inversions may form at any altitude from two to ten thousand feet. The last plot (4) shows the Standard Atmosphere condition with temperature and relative humidity decreasing linearly with height. All of the temperature plots are to be considered as starting from a common surface temperature.

Modified Refractive Index and the M Unit

We have previously stated that Snell's Law gives the bending of a ray entering the plane boundary between two media of different refractive indices. We know, however, that our refractive index decreases with height in a homogeneous atmosphere. Without becoming involved in mathematics, we can resolve this situation if we consider an earth with a radius extended by 1/3. The case where the earth's radius is multiplied by 4/3 is called "Standard Refraction" and corresponds to a linear variation of refractive index with height based on standard atmosphere conditions.

Snell's Law has been manipulated to take this modified earth's radius and "Standard Refraction" into consideration, resulting in a "Modified Refractive Index", expressed in "M" units. The modified unit of refraction is expressed by the amount it exceeds unity and is measured in parts per million, laying in the range of 300 to 550 units. A plot of "M" units vs. height is called an

Fig. 9. Some possible paths of VHF propagation in the troposphere. By letting the imagination complete the dotted lines an idea of the complexity of possible propagation in the troposphere by second hop may be obtained.



M curve. A "standard" M curve results when the air of the lower atmosphere is thoroughly mixed and represents the 4/3 earth's radius approximation.

For those that are interested in the physical makeup of the Modified Index of Refraction it is represented by the following equation:

$$M = \left[\frac{(N-1) + \frac{H}{A}}{T} \right] 10^6 = \frac{79(P-E+4800E)}{T} + \frac{0.48H}{T}$$

where M is the modified index of refraction, N the index of refraction, H the altitude in feet, A the earth's radius, T is the absolute temperature, P and E are the total pressure and moisture vapor pressure, respectively, in millibars.

It has been pointed out (1) that for waves in the radio spectrum the index of refraction of the atmosphere depends principally on its temperature and water vapor concentration. The M curve, therefore, depends upon the distribution of temperature and water-vapor with height. The modified refractive index is decreased by an increase of temperature with height (a temperature inversion) and a decrease of water vapor with height. The slope of the M curve then shows a negative lapse. An increase of water vapor content with height, usually associated with fog, yields a sub-standard M curve with a positive slope. Fig. 8 shows a family of M curves illustrating how various types of inversions may form non-standard atmospheric layers.

Tables have been prepared from which M can be computed from observed meteorological data such as temperature, barometric pressure and water vapor content as a function of height taken by radiosonde technique. These data are accumulated every 12 hours from numerous observation points over North America and are broadcast on schedule by NSS. They are also available at any U. S.

Weather Bureau or CAA aeronautical station.

Predicting Band Openings

In attempting to predict two meter band openings from meteorological data, close scrutiny should be given to lapses in M units. However, it must be borne in mind that radiosonde equipment is born aloft by balloons and does not continuously record data as a function of height but merely samples it. Therefore, although an inversion may be spotted at high altitude, its "thickness" may not necessarily be measured nor sufficient data obtained to calculate the gradient of M in the layer, which we are primarily interested in.

Meteorological maps, showing barometric pressure areas over North America, are published daily in some metropolitan newspapers. Comparison of the shown pressure gradients, with DX conditions noted at the same time, have yielded some very interesting correlations, particularly along the path of steep gradient edges.

It may be well to note that while, over a period of time, lapses in M units and steep pressure gradients have individually been correlated with abnormal propagation conditions, there have also been many times when these correlations simply did not exist. While it is very convenient for those of us that have observed these correlations to shrug off the non-correlation instances with "there was no one on the air", this logic obviously has little basis in scientific fact. In the meanwhile, we are informed that W2PEN is keeping his crystal ball well polished and reports some very satisfactory results in predicting band openings.

Propagation Paths Under Non-Standard

Atmospheric Conditions

Fig. 9 shows some possible propagation paths when a warm air mass of dielectric constant A moves in over a cold mass of dielectric constant B. Or, of course, the cold mass may move in under

(1). Martin Katzin, Research and Development Board—Digest Series No. 141, Oct. '48.

(Continued on page 61)

DXing A LA 3.5 mc

GENE SYKES, W4BRB*

Here's the inside story on 80-meter DX, by the band's outstanding DX man.

DURING THE FALL AND WINTER of 1947 a new phase of operations was added to the over-all amateur picture; Low Frequency DXing. Many operators, jaded by the cut and dried pattern of DX chasing on 28 and 14 mc and looking for new worlds to conquer, descended upon the 3.5 mc band with the express purpose of "opening it up." It is true that long distance communications had been established often and by many different stations in the years prior but such communications were generally coincidental to the normal operations of the stations involved. Therefore, the cool months of '47 can generally be regarded as the beginning of the 80 meter DX era.

In such a movement it was inevitable that certain high-frequency techniques, proven on the "DX bands" should be introduced. Also, it was inevitable that the operators should adopt themselves somewhat to the nature of the 3.5 mc band.

It is well-known that the daylight "skip" in the region around 80 meters is practically non-existent. Therefore it can be considered as a purely night-time DX band. Also, due to the atmospheric peculiar to this part of the spectrum, 3.5 mc yields its best results during the cooler months. Against this may be balanced the fact that the skip on this band is comparatively predictable between two

points and experience has proven that the times at which a certain area may be worked from any other given area may be determined in advance with much more accuracy on 80 than on 14 or 28 mc. This last property allows DX schedules to be made with a higher percentage of hits on 3.5 mc than on the higher bands.

What and When

For example, in the New England states the western European countries will break through as early as 2200 GMT during the months from October thru February and will remain "in" until 0800 GMT. In the southern seacoast states the same Europeans will not ordinarily reach a working level before 0000 GMT (due to the longer period of daylight) and will remain in for approximately the same period. This, of course, gives the northeastern states a definite edge in this department due to the fact that during the favorable winter months they enjoy a longer period of darkness.

In working South Americans this situation is somewhat reversed in that the southern states and those along the Gulf of Mexico will receive a stronger signal somewhat earlier than the northern states. This is due, of course, to the geographical locations which permit these states to intercept the expanding "skip" before it extends up to the more distant northern states and, also, because the signals are less attenuated in coming across the Gulf of

*410 Franklin Rd., W. Palm Beach, Fla.



Those are all 80-meter cards on the wall; Gene has 8 countries worked on this band, and it looks like about 75 confirmations on the wall.

Mexico and Caribbean than they are after travelling another thousand or so miles across the United States. It is a matter of fact that these low frequency signals are attenuated by land masses to a greater extent than the 14 or 28 mc signals.

A fact to be remembered in inter-hemisphere DX-ing is that the seasons are reversed and even though we may experience greater atmospheric interferences during our summer, these will generally be balanced by stronger signals from the southern hemisphere. Argentinian stations have put strong signals into Florida as early as 2300 GMT in mid-summer, which is some two hours before dusk. The same signals will not ordinarily be readable in the northern states before 0100 GMT and, apparently, never do reach the levels reported in the southern states.

South Africans appear to peak throughout the eastern seacoast states between 0300 and 0400 GMT after which there is a rapid and definite attenuation to all signals from this area. Northern African stations exhibit about the same characteristics as Europeans and are, if anything, slightly stronger and easier to work.

The South Pacific area varies in time according to its longitude. New Zealand stations come through as early as 0600 GMT and remain in until 1200 GMT with a peak at approximately 0800 GMT. Australians are hardly ever heard before 0900 GMT and also fade at approximately 1200 GMT on the east coast. The common fade-out at 1200 GMT is undoubtedly coincidental with daybreak in this longitude, and in the more westerly states may be retarded to again coincide with the local daybreak. However, these more westerly states do not appear to hear the South Pacific area earlier—geography notwithstanding—since undoubtedly the DX station must depend upon its local dusk for the necessary “skip”.

The necessity for an “all-dark” path is confirmed by the many contacts between United States and Japanese stations. The Far Eastern stations could not be heard on our east coast before approximately 0830 GMT and faded out at approximately 1100-1200 GMT. They remained “in” for Pacific Coast stations for several hours after this time and the W6s could be heard working them until they, too, faded out on the east coast. Asians located in the near-East are subject to similar conditions governing Europeans and North Africans and appear to come through to the East Coast of the United States from 0000 GMT until approximately 0630 GMT (depending upon the time of their “local” daybreak).

In brief, successful DX scheduling on 3.5 mc is greatly dependent upon a dark-path, and times should be selected that will permit the signal to travel through a dark-path all the way. It has been indicated that VK stations are to be expected in the period between 0900-1200 GMT, for instance, but there is no reason not to believe that they are workable at dusk as well as at daybreak in the more northerly latitudes. *

Antenna and Equipment

3.5 mc DX stations are as varied as those found



A 32V-1 drives p-p VT127A's at a KW. Looks like Gene is worrying over those missing cards.

on any other band. High powered transmitters and sensitive receivers pay the same dividends. However, much of the success of any station is dependent upon its antenna and this is particularly true on the lower frequencies. Much has been said and written concerning the relative merits of horizontal and vertical polarization. It is accepted that for long-distance, low-frequency communication a vertical radiator is preferable. However, the physical proportions of such an antenna makes it an impossibility for most stations. Much of the performance of the vertical antenna can be duplicated with the “ground-plane” vertical which is a much less pretentious system. Reports from several stations using this antenna indicate its excellence. In addition to the favorable vertically polarized characteristic it has the further advantage of simplified (co-axial) feeding with a good match over a wide frequency range and may be located at any reasonable distance from the transmitter. Also, and quite important—the co-axial feeder may be grounded, thus eliminating lightning hazard to a great extent. Further, the grounded coaxial feeder should tend to eliminate to some extent the noises inherent around any amateur station and confine all transmission and reception purely to the vertical radiator.

However, noteworthy results have been achieved by many stations using some form of doublet or zeppelin antenna in the horizontal plane. The fold-

*Editor's note: W4BRB is too modest. There's good reason to believe that long haul DX is possible at dusk here on the East Coast. During the last 80 meter DX season, a lot of us heard him on the band around 0000 GMT one evening, working XZ2EM crossband.

The Monitoring Post

gleaned by THE BRASSPOUNDER

WHEN the emergency boys anywhere in New York City go to work, we can be sure a genuine disaster has occurred! And two such workouts within three days, bringing the total to three within the boundaries of the city since ham radio became a means of such communication, is pushing things a bit hard. *W2TJA* obeyed his xyl and went below stairs to sharpen a knife at 6:30 P.M. on Nov. 22. Turning the switch for light over the workbench also turns on one of his standby receivers, tuned to the N.Y.C. Fire Alarm Freq. A Brooklyn alarm came in; then one for Manhattan, then a first and a second for a location near his home, the second calling for ambulances and rescue companies to respond. An immediate telephone call to the chief dispatcher at fire alarm headquarters brought the news of a Long Island R.R. wreck, and within five minutes of the first alarm *TJA* was all mobiles on two and ten, simultaneously, to get to the location immediately. *W2AAG*, *BAE*, *LGK*, *PQG*, and *ZOS* picked up the alert and immediately began rounding up the mobiles.

Ten-meter mobiles, after police line clearance had been obtained, maintained constant circuits between the wreck and the police precinct headquarters nearest the scene, with one mobile parked at the curb at the police station. A heavy overload on normal telephone facilities required this service. Police emergency trucks equipped with two-way radio, telephone company radio trucks, and several other communications means were not enough to handle the load. *K2BQ* drove in from Westchester and set up a portable station in Flushing Hospital, with all hands working till after 2 A.M.

And three days later, when a storm with gales touching the hurricane force hit the city, the nets again went to work and did not complete their jobs until Nov. 28—four hard days of emergency communications. In Nassau County, the Long Island neighbor of N.Y.C., a long list of accomplishments has been reported: assisting the Red Cross, U. S. Coast Guard, County Police, and other agencies in evacuation work.

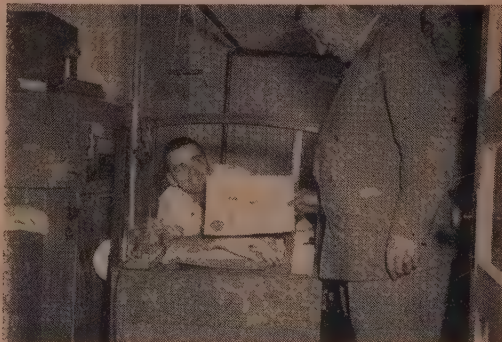
W2FI was called by Red Cross at 10:30 A.M. Saturday asking for help. Put to work immediately were *W2TUK*, *SFV*, *JXP*, *NI*. By noon *W2UOL* was on hand with his truck laden with a 10-meter mobile and other auxiliary radio gear. *W2SPI* and *PG* went into the Long Beach area to work with the Red Cross in evacuation work, at this time there being no telephone lines and but one road open to reach the area. *W4KKM/2* reached the Coast Guard station at Short Beach and worked with them until early the following morning, when normal communications were again available. A 2-kw. gas generator was hauled from the Nassau

County RC clubrooms to Mineola, where it supplied power from 2 to 11 P.M., when power was restored in the county seat. *W2KAZ* and *PQO* had not even time for a cup of coffee, their mobiles kept on the go constantly. *W2BTA* was dispatched to Oyster Bay to survey and supply a report to county Red Cross headquarters—no telephones in this area at all. At Seaford, on the South Shore, *W2JXP/M* stayed with Red Cross field men until 2:30 A.M. the following day when all evacuation had been completed. On the two-meter net continuous communications was maintained with Red Cross headquarters in Mineola, furnishing information regarding conditions, availability of shelters for evacuees, plans for rescue work using Army "Ducks", etc. Thirty-three stations worked ceaselessly—10 mobiles, 2 portables, 21 fixed.

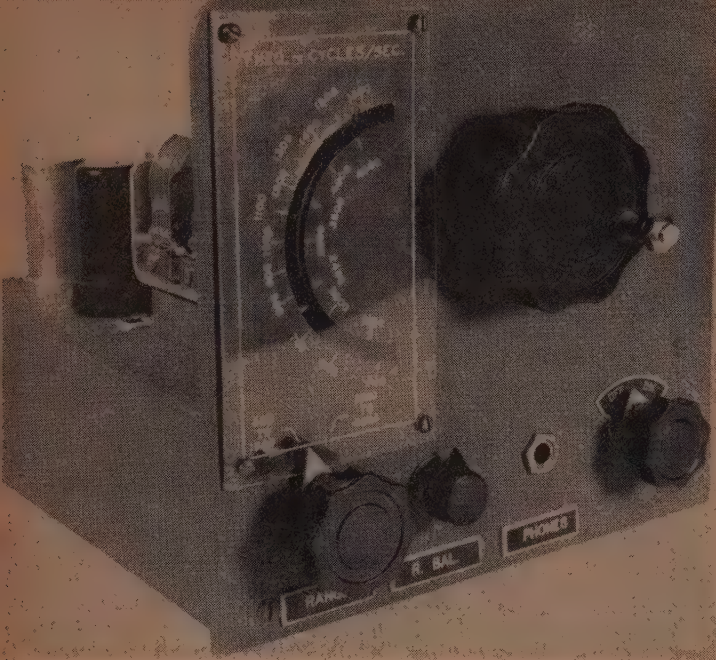
In Queens County trouble began to pile up as Nassau reached the point where their communications were somewhat under control, so mobiles were sent from the latter county to Queens, where two- and ten-meter portable rigs had been set up at Fire Dept. Central Office. Sixty-eight circuits, serving more than 2,000 fire alarm boxes, were out of commission. The work of the portable and mobile stations was not completed until noon of Nov. 28—three and one-half days of intensive emergency communications. Staten Island's ten-meter net served faithfully for long hours assisting Red Cross in evacuation work. A splendid job, but each group, no matter where located, all report a shortage of mobiles. To do a job during disasters the hams will have to become more conscious of the value of mobiles. This is just one more of the many splendid achievements of the Amateur Service.

W5OK reports "yours is the best sig I'm seeing on the band right now", based on what he sees on the scope. He's back on 40, forsaking 75 for a while, and has been licensed for the past 30 years.

(Continued on page 59)



Gov. John W. Bonner, Montana, receiving his "Dog-catcher" certificate from "The Mayor", *W7LCM*.



CLARENCE A. WEST, W2IYG*

Figure 1

The HETERONULL

BECAUSE OF HETERODYNE INTERFERENCE in the crowded phone bands, a heterodyne eliminator operating in the audio-frequency range can be very helpful in the successful completion of phone qso's. The main requirements for such a heterodyne eliminator are:

1. That it be continuously tuneable over the range from a few cycles per second to the maximum sideband frequency passed by the receiver. If a receiver, for example, can separate stations 4 kilocycles per second apart, the maximum tuning frequency of the audio nulling device should be 4 kilocycles per second.

2. That it have an extremely sharp rejection bandwidth to reduce loss of the voice frequencies as much as possible.

The device described in this article, The Heteronull, meets both these requirements.

Operation

The circuit of the Heteronull stems from the RCA Distortion and Noise Meter* and is that of a tuneable audio-nulling amplifier. It is possible, when the audio output from a communications receiver is fed into the Heteronull, to eliminate the audio heterodyne between two stations when the frequency of the heterodyne falls within the tuning range of the device. The Heteronull serves

equally well when used for CW work. It is simply tuned to the interfering CW signal, thereby eliminating this signal and leaving the desired signal in the clear, provided, of course, that the signal to be retained is not blocked out by the interfering signal.

The Heteronull is a tuneable three-stage audio amplifier having a Wien bridge between the 2nd and 3rd stages and employing negative feedback to increase selectivity. The Wien bridge, adjusted by means of variable capacitors, is sharply tuned to filter out the heterodyne frequency.

Construction

Since audio frequencies in low-gain circuits are involved in the Heteronull, there is no need for any special layout or shielding. For experimental purposes, a tuning range of from 500 to 5000 cycles was selected. A chassis measuring 2-1/2" x 7" x 9" was chosen to suit the largest components, the two variable capacitors. Fig. 2 shows the general layout of the chassis. As indicated in the circuit diagram and Fig. 2, these tuning capacitors are insulated from the chassis. One-half inch thick bakelite is used for the insulation. If a dual variable capacitor with common shaft and large enough capacitance in each section is available, some mechanical problems can be avoided. In most cases, however, two identical three-section variable

*Tube Department, Radio Corporation of America, Harrison, N. J.

* Type WM-71A

A Tuneable Audio-Nulling Amplifier for Rejecting Heterodynes.



Figure 2

capacitors were available plus the gears, so these were used. To obtain approximately 1200 uuf, all three sections of each capacitor were wired in parallel. The trimmers, C9 and C10, shown in the circuit diagram, are part of the tuning capacitors. Because the unit draws only a few milliamperes, the receiver power supply can usually be used for B voltage. However, a separate 6.3-volt heater transformer may be required. The tuning capacitors, tubes, and large cathode bypass and plate-decoupling capacitors are mounted above the chassis. The range selector, balancing, tuning, and "off-on" controls, plus the phone jack, are brought out to the front panel as shown in Fig. 1. The "off-on" switch in the "off" position connects the phones directly to the input terminals of the unit and removes B voltages when the nulling action of the bridge is not required. In the "on" position the switch connects the phones to the output of the Heteronull and applies B voltages.

The risk of poor ground connections is avoided by running a heavy piece of copper wire across

the bottom of the chassis to provide a common ground point. Tubes and components were arranged to facilitate short, direct connections. In addition, wiring which might bring input and output circuits close to each other was avoided. A bottom view of the chassis is shown in Fig. 3.

Adjustment

After the chassis is wired and carefully checked, connect an audio oscillator to the input terminals (I used the 1000-cycle station code practice oscillator for tuning up the amplifier). Apply the heater and B voltages and plug in the phones. Throw the off-on switch to the "off" position to make sure the 1000-cycle signal is available at the input. Adjust the trimmers on the bridge capacitors for somewhere near equal setting. Switch to the "on" position and throw the range switch to the low range (Approx. 500 to 1600 cycles). Rotate the tuning knob and listen for the null. Make this adjustment slowly because the tuning is quite sharp. If the null is not heard, try different positions of the balance control, R11, and repeat the tuning. When the null is found, adjust the R balance knob for maximum nulling, then adjust the bridge trimmer capacitors for further nulling. A pronounced null should occur as the bridge is tuned to the incoming signal.

Operation

The earphone output from the communications receiver may now be connected to the input of the Heteronull. Throw the "off-on" switch to the "off" position and tune over the band for two stations which are heterodyning each other. Throw the "off-on" switch to "on" and tune the Heteronull slowly, listening for the rejection of the heterodyne. Try both range positions. A point will be found where the heterodyne will be eliminated, making it possible to "copy" the modulation. If there are several heterodynes, select the loudest and reject it.

The Heteronull is also effective for rejecting

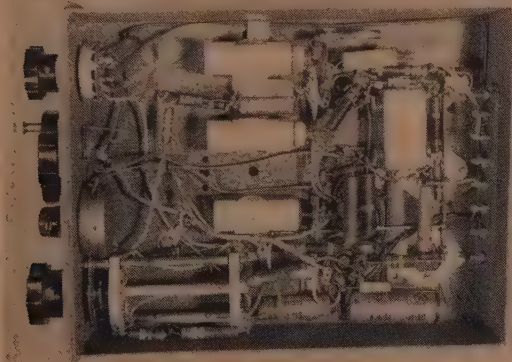
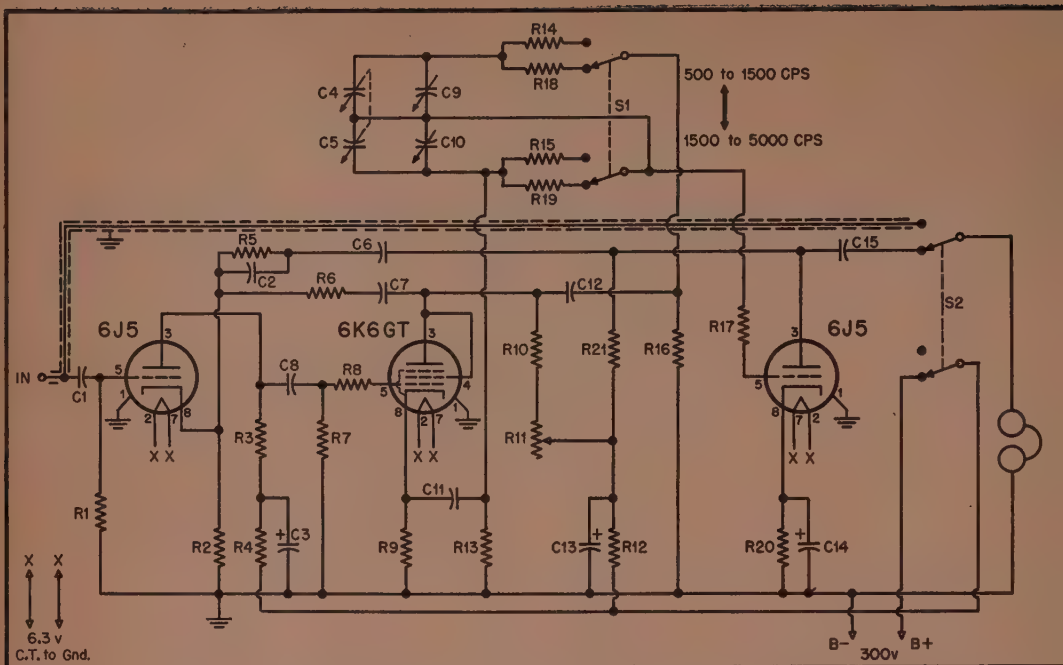


Figure 3



Capacitors
 C1—0.01 μ fd., paper,
 200 v.w.d.c.
 C2—200 μ fd. mica, 450
 v
 C3—20 μ fd., electroly-
 tic, 450 v.w.d.c.
 C4, C5—1200 μ fd., vari-
 able tuning
 capacitors
 C6, C7, C11—1.0 μ fd.,
 paper, 450
 v.w.d.c.

C8, C12—0.05 μ fd. pa-
 per, 450v.w.
 d.c.
 C9, C10—(Approx.)
 50 μ fd trimmer.
 C13—60 μ fd., electroly-
 tic, 450v.w.d.c.
 C14—100 μ fd., electro-
 lytic, 25v.w.d.c.
 C15—0.1 μ fd., paper,
 450v.w.d.c.
 Resistors*
 R1— $\frac{1}{2}$ megohm, $\frac{1}{2}$ w.

R2, R4—8200 ohms, $\frac{1}{2}$ w.
 R3, R21—33,000 ohms,
 2 w.
 R5, R9—3900 ohms, $\frac{1}{2}$ w.
 R6—27,000 ohms, 1 w.
 R7, R13, R16—1 meg-
 ohm, 1 w.
 R8, R17—100 ohms, 1 w.
 R10—4700 ohms, 2 w.
 R11—10,000 ohms, wire
 wound—(balance
 control)
 R12—1000 ohms, 2 w.

R14, R15—184,000
 ohms, 1 w.
 R18, R19—80,000 ohms,
 1 w.
 R20—270 ohms, 2 w
 * All resistors $\pm 10\%$
 except
 R14, R15, R18 and R19
 = $\pm 5\%$
 S1—DPDT Range Switch
 S2—DPDT Off-On
 Switch

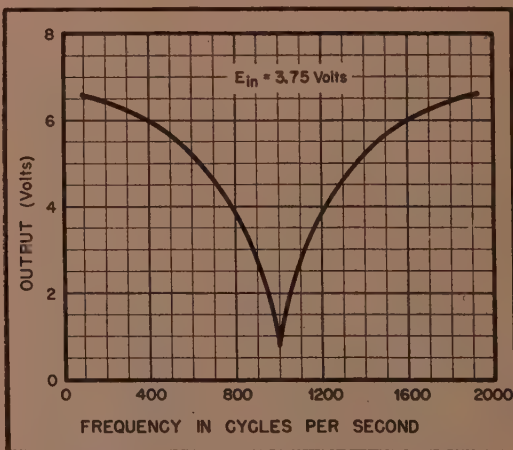
an unwanted CW signal. Tune into the CW band and locate two CW signals which are close enough to interfere with each other. By tuning the Heteronull, it is possible to reject either of the signals with no change in the other.

Other Uses

The Heteronull may be put to several other useful purposes provided that the tuning knob is calibrated. The calibration of the device may be accomplished as follows: Fasten a sheet of heavy white paper beneath the pointer of the tuning knob. Be sure to mark the exact position of this template if you plan to later remove it for use in preparing a fancier dial as was done in my case. Careful marking allows one to return the final dial to the same position without disturbing the calibration. Next, connect a calibrated audio oscillator to the input of the device and a pair of headphones or audio output meter to the output. Start at one end of the dial to be calibrated and mark calibration points all along the dial at suitable intervals by nulling the known frequency of the input signal. Repeat this calibration procedure for all ranges. From the template a neat dial may be

made, or as was done here, a tracing was made and a photostat obtained. The photostat was then covered with a sheet of 1/16" plexiglass and fas-

(Continued on page 59)



Selectivity characteristic of the Heteronull

DX

AND OVERSEAS NEWS

Conducted by HERB BECKER, W6QD*

WE WOULD LIKE to offer our sincere congratulations to the following DX men who have achieved WAZ. The certificates have been awarded as follows:

| | | |
|-----|-------------------------------|--------|
| 240 | PY1GJ Roland Pereira de Souza | 40-199 |
| 241 | W7IYA Rick G. Price | 40- 59 |
| 242 | W6BUY Jack Holmes | 40-157 |
| 243 | W3GAU Joe Gillson | 40-183 |
| 244 | W3IYE Ray A. Belair | 40-214 |
| 245 | W3JTC Larry Eisler | 40-224 |
| 246 | VK6RU James E. Rumble | 40-186 |
| 247 | W3JNN Oscar L. Short | 40-215 |
| 248 | W3KT Jesse Bieberman | 40-222 |

It looks as though the W3's hit the jackpot this month. As you will see, there are five of them listed above. W7IYA should take some sort of a prize for working the smallest number of countries and yet made WAZ. This was a case of a man gunning principally for WAZ with little emphasis on countries. Rick has subsequently moved and is now W9IPX. It is good to see W6BUY in there and we certainly can't overlook VK6RU whose station has given Zone 29 to many many Hams throughout the world, and then last but not least PY1GJ. None of the above really should need any further introduction to you.

W2HJM is getting fed up with this DX business, as he seems to think that his 250 watts can't compete with the power houses around the country. Then of course conditions haven't exactly added to his happiness, so from the way things look Augie is pulling the switch until things get better all around.

W9LM still has enough energy to work in a DX contest. Hal thinks it is going to be good in a few years when the sun spot cycle is on the increase and, at the same time, wonders if we old fellows will have to be wheeled up to the operating desk in a wheel chair when it comes contest time. Maybe a Wheel Chair Club wouldn't be so bad at that.

KL7PJ has his rig and shack in a hall closet. He generally runs 350 to 400 watts into the 813 final while the receiver is an NC-173 with pre-amp and audio filter. Chuck says the Anchorage Amateur Radio Club has started up again and looks

like they will do O.K. with about 25 to 30 attending the last meeting.

W6ETJ worked FO8AG, who is on Makatea Island, and usually can be found at about 14120. For a lot of the old timers, this fellow is ex-F30CD who was on around 1931. His name is Emil Helme. W6ETJ got a tremendous bang out of working him the other day since the only other contact he has ever had with him was in 1931.

OE1FF is moaning about the fact that he doesn't get much of a chance to stay home and work DX. He is on the move again, and this time to HB for a few months. He managed to knock over a few new countries when he was home in November, as well as XZ2SY for a new Zone.

DL3AB just discovered that when he worked VK1FE a year ago, he didn't realize that it was a new zone for him. Anyway, I guess in looking back over his log it finally dawned on him. Adolf has also added three new countries to his list. This makes him 39 and 106.

W1NLM thought he had something when he worked VQ9AA. He drew a bead on him with his rotary and found he was about 45° off. All good things come to an end, and in this case it



SM5RM on the air, and his XYL doesn't seem to mind.

*Send all contributions to Herb Becker, 1406 South Grand Ave., Los Angeles 15, Calif.



This composite of three photos taken at EK1AO's QTH helps explain his outstanding signal on all bands. The

happened when he read about the doubtfulness of VQ9AA in the December column. . . . W6AM is doing a little more phone work these days and added YJ1AA and 4X4CR. Another new one for Don on c.w. was VK1RF on Macquarie.

W5GEL nailed down VP5BH on Grand Cayman, 7018 kc. He was running 40 watts into a pair, of 807's. . . . W5FFW worked VU2GJ 14060 and FF8AC 14040 for a couple of good ones. . . . W9HUZ has added a few including FK8AH, FQ8AE, VS7KR, and CR5AC.

From the Southern California DX Club Bulletin I see where W6PFD has acquired the rig of W6TSW and this includes key clicks. Remember, I am only quoting, but I won't argue. . . . Apparently W6FSJ found out through FK8AI that FW8AA is on the air on Wallis Island, but up to now has only had one contact—this being with FK8AC on 40.

W6TT was one of the few to work 3A2AB on phone. Elvin also connected with VR1F as well as ZK2AA making his phone total 142. . . . It is good to hear from W5MPG for the first time. It seems that he has just put up a new 3-element beam after being off the air for quite some time. The old beam came "tumbling down" as he puts it, and with a new telephone pole supporting this

present rotary, things are on the up again.

The other day W8EBC was saying the snow on the level was 1/4 wave on 440 mc. and drifts it was 1/2 wave on 5 meters. . . . W6EF sewed up Macquarie good and proper when he worked VK1RB and VK1RF. . . . G6ZO still carries a horse shoe as was proved when he worked

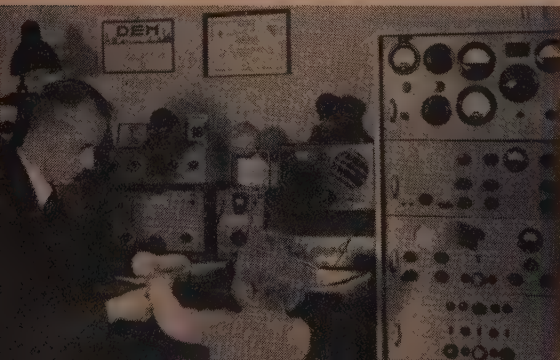


11RB in a contemplative mood.

YJ1AB. This was done on 20. . . . W5ME crawled into the phones in order to hear VU2C when he worked him. In other words, it was one of those QSO's "UR RST 599 FB Sig, OK. Pse repeat last transmission."

W3CHH, whom many of you will remember as W3CHH/IWO, is still getting many cards from stations he worked while on Iwo Jima. He actually sent cards out to everyone he worked from there, but still has a few for those of you who haven't received his. You might, however, check with your QSL Bureau, because it could be that yours is waiting for you there now. If you should want to get in touch with him, write

DLIEZ and his jr. op.





ZB2 in the center, and the EA coast on the horizon. EKIAO has been working W's on 160 recently.

J. J. Frekot, W3CHH, 7236 Rupert Street, Philadelphia 24, Pennsylvania.

W9NZZ has just about given up ever getting his Zone 19 card from UAØKFD . . . F9BO was another one who worked HV1A, but a letter from Vatican Radio told him the guy was a pirate, and no amateur stations were known in the City. . . W7HXG lost his 20 meter beam in a recent wind storm, so in its place he now has a 4-element 10 meter job and has been working 10 phone for the past couple of months. . .

I appreciate this, Clif. Now, how about bringing yours up to date?

It looks like the Tri-State Amateur Radio Society has some new officers, the head man being W9HX and the V.P. is W9DGA. The secretary (who probably does all the work—and I know I'll hear about this crack) is W9AZJ, and the guy who handles all the dough is W9QLW.

I wonder how many of you heard a couple of recent newscasts of Lowell Thomas relative to Bob Ford, AC4RF? For those of you who haven't heard, apparently AC4RF has been arrested by the Chinese Communists on some sort of a charge which I am sure most of us will bet is not true. According to the Lowell Thomas broadcast, Bob is accused of murdering a Tibetan monk with a poisoned cup of tea.

GM3CSM is still trying to get all the W's to QRP—all of them, that is, over 100 watts. He says when the W pack is in full cry the bagpipes don't stand a chance. Ian spent a little time in Denmark and Sweden meeting quite a few Hams.

Remember, fellows, last month I mentioned something about you phone DX men sending in a little more of your DX? Of course, it's got to be on the air to work before you send it in, but nevertheless keep it in mind and let's see if we can't once again

have a little more phone work reported. Even my W9's let me down this month. What happened? 73.

Q T H COLUMN

CP5EK
CR5AF
CR7IV
FF8AC

Box 496, Cochabamba, Bolivia.
Box 206, Bissao, Port. Guinea.
Box 595, Beira, Mozambique.
Box 19, Port Etienne, French West
Africa.

FK8AH
FO8AG

Via W6AGS.
Emile Helme, Makatea Island, French
Oceania.

FQ8AE

Box 69, Ft. Lamy, French Equatorial
Africa.

VK1RF
VP5BH

Via. W. I. A.
Alvin Hanlan, Georgetown, Grand
Cayman Island, B. W. I.



The comfortable looking shack of XZ2SY.

W. A. Z. HONOR ROLL

| CW & PHONE | CW & PHONE | CW & PHONE | CW & PHONE | CW & PHONE | PHONE ONLY |
|------------|------------|------------|------------|------------|------------|
| WAZ | | | | | |
| W1FH 234 | W6RW 190 | W6EYR 150 | OZTEU 169 | W6CAE 113 | G8IG 159 |
| W6VFR 234 | W6SRU 190 | W6RLQ 150 | W4VE 169 | KL7PJ 112 | ZL1HY 157 |
| W3BES 232 | W6EPZ 190 | W6LER 150 | HC20T 169 | W7EYS 107 | W1HKK 153 |
| W6ENV 230 | VK3JE 189 | W6ATO 149 | PY2AB 168 | W6FXL 92 | W6KQY 151 |
| W2BXA 229 | ON4JW 189 | OK1CX 147 | W2BJ 168 | C1CH 84 | W9NDA 146 |
| W6EBG 227 | W5GEL 189 | W6LS 147 | W4DKA 168 | 37 Zones | W6AM 139 |
| W6YXO 226 | W6NTA 189 | W4CYV 147 | W2CYS 167 | W1KFV 171 | 37 Jones |
| W6PFD 226 | W6AMA 186 | W7KWC 147 | VE3AAZ 166 | W2ZA 160 | XE1AC 192 |
| G6ZO 226 | W85DR 186 | W6AYZ 146 | W8LEB 166 | W3WU 157 | W1JCX 179 |
| W6ADP 225 | VK6RU 186 | VE6GD 146 | W4BRB 162 | W3PYS 147 | W9RBI 175 |
| W6MEK 225 | W2CZO 185 | W9NBR 145 | W4AZK 159 | ZL3CC 143 | PK4DA 170 |
| W6GRL 224 | W6BRN 185 | W6MUC 145 | GM3CSM 159 | GM2U 142 | W3LTU 169 |
| W3GHD 224 | G8IG 185 | OK2SO 145 | W0GKS 158 | W4ML 140 | W8REU 163 |
| G6RH 224 | W6SA 184 | ON4TA 144 | W4OM 158 | W5MET 137 | CE3AB 163 |
| W3JTC 224 | KH6VP 184 | G3BI 144 | W0AIW 157 | W2WC 136 | W7MBX 158 |
| W3KT 222 | W3GAU 183 | KH6PY 144 | I1AY 157 | W9HUZ 134 | VK3BZ 158 |
| W3LOE 222 | LA7Y 182 | W7LYL 143 | W9ABA 156 | W2AYJ 133 | W6WNH 157 |
| W6GSN 222 | W0ELA 182 | I1XK 140 | VK4DO 156 | W7HKT 130 | G3DO 155 |
| W6F5S 219 | W6KRI 181 | W6ONZ 139 | W9YNB 155 | W4DIA 130 | G2PL 154 |
| W6ITA 219 | W6IFW 180 | W6ID 138 | ZC4C 138 | W1APA 126 | W6PH 153 |
| W8BHW 218 | W6EHR 180 | W6NTR 138 | W8VLK 155 | VE5JV 127 | W3JNN 150 |
| W3EVW 218 | CE3DZ 180 | OK1WX 135 | I1AIV 154 | W9LNF 122 | W8BF 146 |
| W6AM 218 | W6UHA 179 | G3AZ 133 | W9TQL 154 | VE1EA 116 | W6TT 142 |
| W6TT 217 | VK4HR 178 | W6TEU 133 | W2RDK 152 | W6AX 110 | F8VC 124 |
| W6SYP 217 | G3DO 178 | W6RDR 133 | G3AKU 150 | W0PFW 108 | W7MBW 107 |
| WOPNQ 217 | W9VND 178 | W6OBR 131 | DL1AT 150 | W7PK 104 | C1CH 83 |
| G2PL 216 | W7DL 177 | ZS2CR 131 | SM5VI 148 | W8HSW 104 | 36 Zones |
| W2PEO 215 | W0UOX 177 | W6IDZ 130 | W2COK 146 | W2H5S 99 | WINWO 176 |
| W7AMX 215 | VK6KW 177 | W7ASG 129 | W2GUR 146 | OH3OE 93 | W1MCW 172 |
| W3JNN 215 | W6UZX 177 | W6BIL 128 | W2MEL 145 | KL7KV 88 | W1BEQ 164 |
| W3IVE 214 | LK1FY 176 | W7GBW 127 | W6LGD 145 | 36 Zones | W9HB 160 |
| W2AGW 213 | W6BRN 176 | G8IP 127 | W9HUZ 145 | W4HA 151 | W4ESP 152 |
| W4AIT 213 | KH6CD 176 | G5BJ 126 | OK1AW 144 | W9WCE 136 | W2DYL 140 |
| VK3BZ 213 | W1AB 175 | PK6HA 124 | W6KYV 143 | O4AK 128 | W9BZB 139 |
| PY1DH 212 | W6WKU 174 | G5VU 124 | TF3EA 142 | VE1PQ 128 | GM2U 135 |
| W8BRA 212 | W6CIS 174 | W6NRU 123 | W9DUY 140 | I1IZ 126 | W9HF 131 |
| CE3AG 212 | W7FZA 174 | W6MLY 123 | W5FFW 140 | W3AYS 124 | W6PDB 130 |
| W6MX 211 | W6PCS 174 | ZS2CT 113 | W6KNT 135 | F8TM 124 | W1FJN 128 |
| W6NNV 211 | W6KUT 174 | KG6AL 103 | W9NZZ 134 | W9L 124 | W8AUP 128 |
| W2ACK 211 | W6T2D 173 | VK6SA 103 | W6L 133 | SV1RX 121 | G6BW 127 |
| ZL2GX 211 | D17AA 173 | W7KWA 98 | W7ETK 132 | W2BF 115 | VE3BNQ 126 |
| W6SAI 210 | G5VY 172 | W6DUB 89 | W6TE 131 | 4X4BX 112 | VE7HC 123 |
| W6BPD 210 | OK1LM 172 | W7IVA 59 | CR9AG 131 | G3BPP 111 | W0HX 120 |
| W6MJB 210 | W6WWQ 172 | 39 Zones | W6WJX 131 | W5CD 108 | W3GHD 114 |
| W6OEG 210 | W6SRF 171 | W8NBK 219 | W5CPI 130 | E1AB 103 | W8CYL 112 |
| W6DZZ 209 | PY1AHL 171 | W3DPA 219 | W7BTH 129 | W2JA 102 | W3DHM 96 |
| W9VW 209 | OK1HI 171 | W9ANT 218 | OE3CC 128 | W5BK 99 | W6SA 92 |
| W2AQW 208 | VK2HZ 171 | W9RBI 214 | DL1DA 127 | VE8AS 98 | F8DC 87 |
| W8HGW 208 | W6LN 171 | W2NSZ 214 | VR5PL 124 | 35 Zones | 35 Zones |
| W9NDA 208 | W7OY 171 | W6NOC 211 | W6M 124 | W2OST 146 | HC2JR 158 |
| ZL1HY 208 | OE1CD 170 | W3OCU 210 | W6MUF 122 | W1BFT 141 | ZS6Q 156 |
| W6SC 207 | W6BAM 169 | W1ENE 209 | KG6GD 121 | W4DHz 132 | W4HA 142 |
| VE7ZM 206 | W6PZ 169 | W1BIH 209 | W7HXG 120 | W9CKP 132 | W6PCK 141 |
| W4BPD 206 | W5AFZ 169 | W2HHF 208 | DL3DU 118 | W5FXN 125 | W9RNX 140 |
| LU6DJX 205 | G2VD 169 | W1JYH 208 | W6NRZ 117 | OZ7BG 124 | W2RGV 136 |
| W6MVQ 205 | W6JUZ 168 | F8BS 206 | KL7UM 117 | W5JUF 121 | HC2OT 134 |
| W6PQT 205 | W6ANN 167 | W3EPV 205 | ZS2EC 116 | G6QX 121 | W6CHV 133 |
| W6ZCY 204 | VK3CN 167 | W5ASG 203 | W6JWL 114 | W6ZZ 120 | W2GHV 131 |
| W6DI 204 | W6LDD 167 | W5LVD 203 | W6EYC 114 | W9RQM 119 | W09R 130 |
| W6PKO 204 | W6BVM 167 | W9LU 201 | KL7GG 114 | CO4AJ 119 | W9BVB 130 |
| VK2D1 204 | W6DUC 166 | W9BQ 201 | W6VAT 113 | W9GGA 115 | W0PRZ 124 |
| KH6CT 203 | KH6MI 166 | W6FCB 110 | W9FNR 114 | W9FNR 114 | W9CKP 124 |
| W4CYU 203 | W6CEM 166 | W2HZY 200 | DL3AB 107 | W8AVB 113 | W9CKP 124 |
| Z5ZK 203 | W6JK 165 | W2WZ 198 | W7GXA 105 | W0GBJ 110 | G8QX 123 |
| VE4RO 203 | VE7GI 165 | W4GG 197 | W6LEV 103 | W2HAZ 109 | W8ZMC 122 |
| W7GUI 203 | W6LRU 165 | W2GWE 195 | W7LEE 91 | KZ5IP 108 | W0PUE 117 |
| W6RM 202 | W6BUD 165 | W3DKT 195 | 38 Zones | ZL1QW 99 | W5LVV 108 |
| W6OMC 202 | W6BZE 165 | W2CWE 192 | W2HJM 192 | KL7CZ 69 | W4OM 106 |
| W6PB 202 | W6EAK 163 | W9LNM 192 | W1HX 191 | 34 Zones | W3PA 105 |
| W6AOA 202 | W6YZU 163 | W1X 191 | W2PUD 180 | W1DEP 150 | 34 Zones |
| KH6IJ 202 | VE7VO 162 | W2AGO 191 | CM2SV 174 | W8NS 133 | W5ASG 142 |
| W6DLY 202 | W6PH 162 | W1AWX 191 | W8KPL 173 | W1NLM 130 | W3KT 129 |
| W6GDI 201 | ZS6DW 162 | OK1VV 190 | W8FJN 167 | W4IYT 127 | LURCW 129 |
| W6TS 201 | W7ENW 162 | W2EMW 187 | W2SHZ 160 | W3MZE 126 | W5KC 125 |
| W9KOK 200 | VK4EL 162 | W8SYC 187 | W8EYE 158 | W1MRP 118 | W2ZVS 125 |
| KH6BA 200 | W6PDB 161 | W3JKO 186 | W2GVZ 158 | W5NTT 107 | W4ZLM 124 |
| VK5JS 200 | OK1SY 160 | W0EYR 186 | W2UEI 156 | W8JM 102 | ILAXD 124 |
| W6RRB 200 | VK3EK 160 | W9MXX 185 | LU7CD 155 | W6VBI 100 | W6UZX 123 |
| PY1GJ 199 | W6PUY 160 | W1ZL 185 | 4X4RE 146 | G2BVN 91 | W8BIQ 122 |
| W6EFM 198 | JA2KG 160 | KP4KD 185 | W3LVJ 145 | W9WEN 83 | W5JUF 117 |
| W2IOP 197 | W6MHB 160 | W8RDK 184 | W8ZMC 143 | W8PCS 80 | W0ANF 115 |
| W0DU 197 | I1IR 158 | F9BO 183 | ZS2AT 143 | W6EUV 66 | W1BPH 105 |
| DL1FF 197 | W6CYI 157 | W3DRD 183 | W0AZT 143 | W6OKL 61 | W8UTG 100 |
| KH6QH 196 | W7BD 157 | W4NL 183 | VE2BV 140 | 33 Zones | W4IWO 100 |
| PY1AJ 196 | W0OUH 157 | W3KDP 181 | W9FKH 135 | W4QN 110 | W2SEI 100 |
| W6WB 196 | G3TK 157 | W1DQH 181 | W9TQL 180 | W2SEI 100 | W8QBF 92 |
| G2FSR 196 | W6QD 157 | W9TQL 180 | VE3ACS 134 | W8SQ 85 | W0BFB 70 |
| G4CP 195 | W6BUY 157 | V0GEP 179 | W6ETJ 132 | PHONE ONLY | W2NXX 65 |
| W6UCX 195 | W7BE 156 | VE3JL 177 | W4FPK 131 | 39 Zones | 33 Zones |
| W5KC 195 | KH6LG 156 | W9FKC 175 | W2PQJ 130 | W6DI 192 | W9MIR 131 |
| G6QB 195 | W6BAX 155 | W2CNT 173 | W4LQN 130 | VQ4ERR 187 | W5ALA 126 |
| OK1FF 194 | VK5KO 155 | W8CVT 172 | W3ZN 129 | W6VFR 173 | W9WCE 119 |
| W6GAL 193 | G3AAM 154 | W4LVV 171 | W0RBA 129 | HB9DS 164 | W2ZW 115 |
| W6TI 193 | W5KEV 153 | W2RGV 171 | W9MNP 126 | W7HT 161 | ILVS 111 |
| ZL1BY 193 | G3YF 152 | W7PDS 171 | F8SAB 126 | VE7ZM 145 | W8BFB 114 |
| W6AVM 192 | G2IO 152 | W9LM 170 | W0TB 122 | DL1FK 125 | W8SDR 113 |
| W6HX 192 | VK2QL 151 | W6CTL 169 | GW4CX 120 | 38 Zones | W8NSS 112 |
| W0SOO 192 | W6LEE 150 | W1NMP 169 | W0FET 118 | W2BXA 168 | VE3BQP 108 |
| VK2NS 191 | W6FHE 150 | W3JTK 169 | VE7VC 116 | W4CYU 160 | W2PQJ 100 |

UP AND AT 'EM

CARL A. WEIDENHAMMER, WIZL*

Having trouble getting out? Here's the encouraging story of a simple vertical that really does a job for WIZL.

IN THIS, THE AGE OF SUPER-POWER, four-element wide-spaced beams and rhombics, the newcomer who has been mesmerized by the DX merchant's tales of contacts with the far-away places with the strange sounding names, or the casual communicator with a yen for a flyer in the DX market, may find himself restricted, antennawise, by the physical dimensions of his property. He puts up a horizontal, half-wave doublet or Zepp for twenty or forty, and finds that he can't get optimum height for the span. After calling the rare ones time and time again and hearing them come back to somebody else, the DX aspirant goes back to viewing the man on the pogo stick behind the Venetian blinds. He could have spared himself complete disillusionment by remembering one thing—low angle of radiation. With his horizontal half-wave he had been spraying the heavens with a barrage of vertically-directed energy.

What to do about it? He should have built up, not out—vertically instead of horizontally. We did, three years ago, just out of curiosity, and results were like a shot in the arm.

The vertical half-wave has been maligned by many authorities for years and dismissed with the damning contention that it transmits signals that are equally weak in all directions. This holds, quite obviously, when the vertical is erected over poor ground that is barren of moisture. When used over marshy ground, however, the upright half-wave becomes a very effective DX radiator.

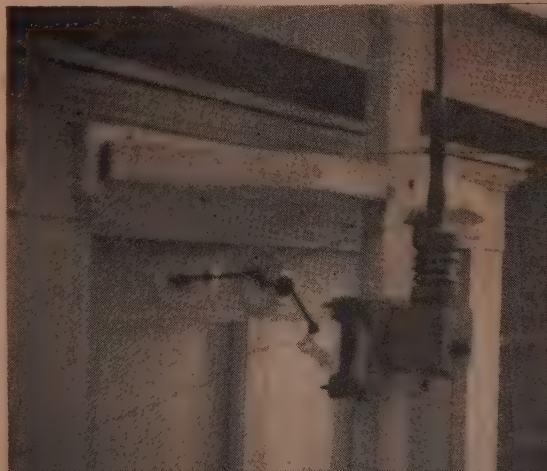
If you live near the seashore, by a lake or a river, or near marshland, reflection will be maximum and reinforcement realized to the full provided the base of the vertical half-wave is approximately one-tenth wavelength above ground. In lieu of naturally perfect ground, copper radials of several wavelengths can be laid or buried to simulate artificially the ideal reflection surface. Low angle radiation can be obtained with a minimum of effort and construction by the antenna under discussion.

There is no antenna that will work equally well on all bands. In our case a compromise had to be

reached, so we built the vertical as a half-wave-length for 20, and decided to investigate its ten and forty meter possibilities when necessary. Operation on 80 was also considered if proper loading could be arranged.

Surplus ads in "CQ" and occasional excursions to lower New York's "radio row" made us acutely aware of the Signal Corps MS53 screw-in type vertical antenna units and the MP series whip antenna spring-action bases that were used on military mobile equipment during the last war. The elements, threaded male at one end, female at the other, can be purchased in five diameters, allowing a taper to the antenna peak. They are made of tubular steel, copper-coated, and painted, and have knurled collars at the ends to facilitate the tightening process. From the extremities of these knurled sleeves the measurement is three feet, two and one-sixteenth inches. Allowing approximately eighteen inches for a lead from the base connection to the antenna coupler in the shack, ten sections were necessary to give us thirty-three and one-half feet. There are six models of the base obtainable in surplus, the difference being the size of base insulator. The spring action feature of the bases in military service allowed the mobile antenna to be swung down to the horizontal when overhead obstacles threatened passage. The slight "give" that results when high winds in the direction of spring tension bend the antenna, serves as a shock-absorber and reduces some of the torque at the base.

* 233 Harbor Rd., Southport, Conn.



This closeup shot shows the mast base and the cleat which braces the two by three. The 33 ft. counterpoise goes off to the left.

Supporting the antenna was ridiculously simple. A piece of reasonably clear two-by-three fir stock, eighteen feet long, was used as the foundation unit. To it was spiked a section of one-by-two fir, six feet long, allowing two feet for overlap. This extra section will not be necessary in most localities, but is was used at our place because of frequent high winds.

The wooden support assembly was placed on the ground and the antenna base clamp plates bolted around the two-by-three, seven feet from the bottom. A screw-in type corrugated glazed porcelain stand-off insulator eight inches long was attached to the top of the two-by-three and another to the top of the one-by-two. With these as separators and supports, the antenna proper was assembled along the pole. The corrugations of the insulators served as convenient channels for the elements which were fastened when spacing was even, with butterfly hitches of heavy antenna wire. The joints were carefully taped with scotch tape and sealed with glyptal. The over-all assembly was then painted.

The entire assembly can be walked up to the perpendicular by one person, but a helper was employed to steady the antenna during the nailing-down process. Figure 1 shows the orientation of our particular installation, but any other kind of support that is convenient can be employed. The most attractive feature of the antenna and its support is simplicity. A comparable vertical half-wave of antenna wire would require a forty-foot stick with all of the inconvenience of guying and associated evils.

The methods of coupling and the constants used at W1ZL on 10, 20, 40, and 80 meters are shown in Figure 2. Maximum efficiency is realized on 20 and 40, but very satisfactory results have been had on 10 and 80.

Over-all results with the Versatile Vertical have been most gratifying during the past three years.

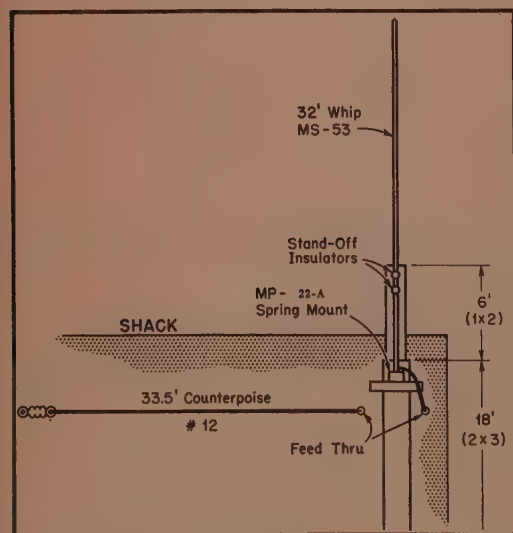


Figure 1

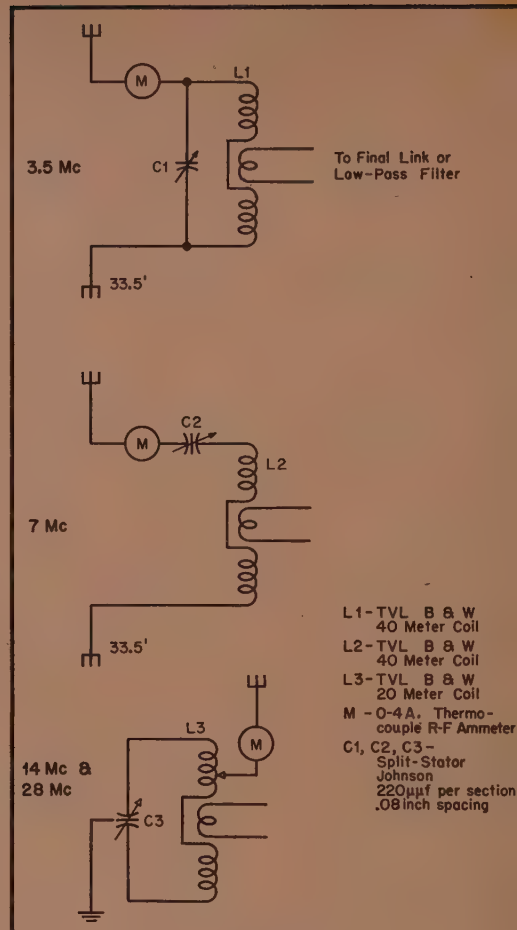


Figure 2

With transmitter inputs of two hundred watts and less, one hundred and eighty-six countries have been worked in thirty-nine zones, with one hundred and seventy-one countries confirmed. Reports from VS1, VS2, VK6, and points equally distant are rarely less than S7 on the 20 meter band unless conditions are extremely poor. The kilowatt with the big beam may cross the finish line first, but the vertical never fails to place or show. In the DX Derby it's nearly always jockeying for position that counts.

On the forty meter band where all men are almost equal, the "30 up and 30 out" combination recalled by Smith,¹ and first used by us in 1925 acts as a modified ground-plane antenna and lays down a fine low-angle signal to all parts of the world. ZS1, ZS2, and VK6 have been worked from this location on 40 in bright daylight late in the afternoon. During the hours of darkness WAC has been made many times.

Eighty meter activity has been restricted somewhat because of lack of time and inclination, but occasional jaunts to that band have resulted in

(Continued on page 52)

The AUTO CALL

R. V. ANDERSON, W3NL**

Another CQ "first" — an automatic calling system which is immediately applicable to any amateur emergency net.

THE AUTO CALL IS A DEVICE by means of which a station can be called whether or not the operator is on the air at the particular moment. The Auto Call grew out of a requirement of the Washington Mobile Radio Club for contacting another station in case of emergency. One of our members happened along after a very serious automobile accident quite late at night when most hams had closed down, and was unable to obtain assistance by radio. He had to drive three miles over icy roads (the cause of the accident in the first place) to get to a telephone. This was a very poor showing for ham radio and we resolved this should not happen again.

In considering a device for calling purposes, we first imposed one requirement: The system should be operable by any mobile station, with no addition of any kind required at the mobile transmitter. This precluded the use of resonant relays, tuned filters, etc., but did not prevent the construction of a satisfactory device. It was finally decided the design should be centered about a standard receiver, the audio of which would be modified with a high-pass filter to eliminate voice modulation. The speaker normally would be disconnected, the output tube operating instead a plate relay which would in turn operate a "dial system." Once operated, the "dial system" would disconnect the high pass audio filter, plate relay, etc., and connect the speaker to the output tube. The mobile operator would merely whistle the pulses required for the dial system after which he could talk directly to the fixed station.

****2818 Que St., S.E., Washington 20, D.C.**

*The AN/TRT-2 and AN/TRR-2 Radio Set is a battery-operated RF stage, super regen det., audio discriminator, and amplifier operating a stepping switch with specific audio-tones and pulse sequences. It did not function satisfactorily for a call system; however, the stepping switch is ideal for this application.

Top view. The receiver section is in the upper right hand corner.

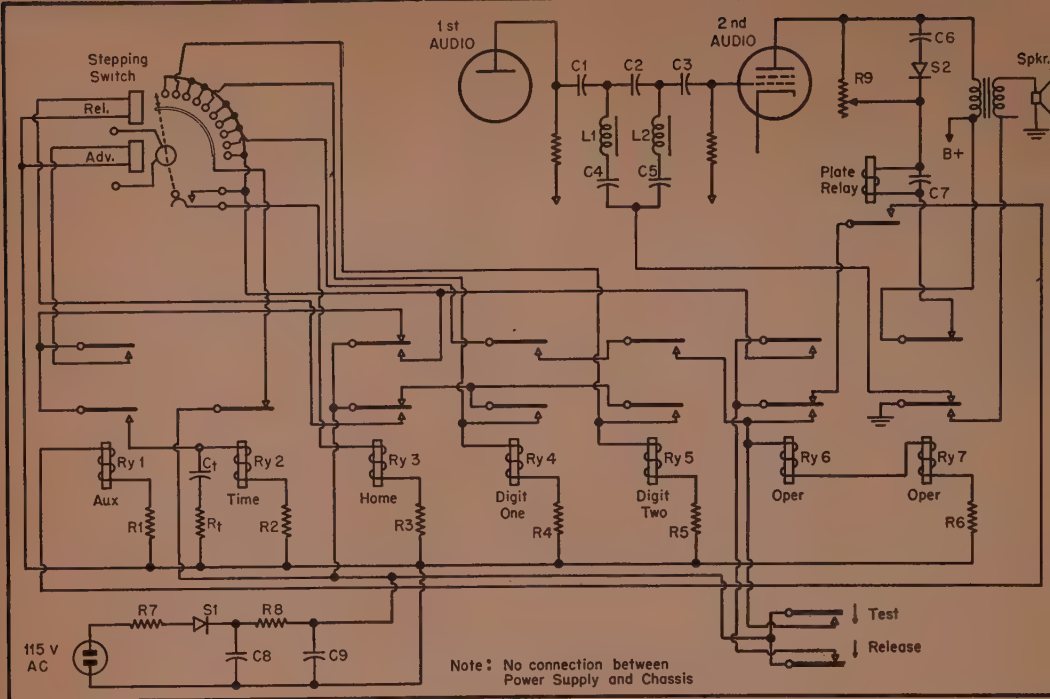
After the usual mathematical computations on audio filter design, with the invariable result that final figures designated chokes and condensers of odd sizes that couldn't possibly be found, it was decided to try standard components and see what happened. The result is the high-pass filter shown, which cuts off roughly at 1000 cycles. It has proven very satisfactory, eliminating false operation on voice modulation, except from very strong signals.

Details of the System

There are a great many ways to build the pulse system. After considering various electronic systems, relay systems and combinations of these, it was finally decided to use a straight-forward relay circuit using "junk-box" relays. This required 2 or 3 more relays than some other methods, but it produced a circuit which can be built from equipment normally available to any ham. The one unit not normally found in the junk-box is the stepping switch. This particular unit used a Miner switch which is available on the surplus market,* but the magnets will probably have to be re-wound for 110v d.c. Mine were rewound with No. 38 enameled wire, giving about 1500 ohms. There are a number of other commercial switches which are available; the main point is that the switch must reset instantly from a single pulse and not "go on around" to do it.

DC for the relays is provided by a standard 250 mil. selenium stack and two 50 or 100 mfd electrolytic capacitors. Resistance as required is





Ry 1,3,4,5,6,7—Any relays which will operate on 25 ma or less, 600 ohms up.

Ry 2—Any relay which will operate on 10 ma or less.

R 1,2,3,4,5,6 — Current limiting resistors if required. With 600 ohm relays should be about 3500 ohms 10 watt each.

R 7,8—50 ohms, 5 watts
R 9—50,000 ohms. Wire-wound

Rt, Ct, = depends on Ry 2 and R2. Suggest 20 mfd and 1000 ohms.

C 1,2,3,4,5,6—.02, 400 v paper.

C 7—4.0 mfd elec, 15 v.

C 8,9—50.0 mfd 150 elec.

S 1—250 ma selenium stack

S 2—60 ma selenium stack

L 1,2—ac/dc choke (Merit C-297)

added to the relay coils to permit operation from the higher voltage. Time-delay on the "Time" relay was provided by an RC circuit, thus eliminating a special slug type relay. An auxiliary relay was provided to repeat the plate relay because most plate relay armatures are delicately balanced; the slightest contact arc causes the points to stick. With two contacts available on the auxiliary relay, it's easier to make the time-delay relay function.

Referring to the diagram, the Auxiliary relay repeats the plate relay; the Time relay furnishes the delay necessary to discriminate between pulse sequences; the Home relay resets everything to the home position; Digit 1, digit 2 relay and the "Operate" relay are operated in succession as the result of the correct sequence of pulses. *Stepping switch connections are drawn for the pulse sequence 2-3-4.*

When the Auxiliary relay operates, current is supplied to the Time Relay and to the Advance magnet of the stepping switch, advancing it one point. When the Auxiliary relay releases, the

Time relay will remain operated until Ct discharges. Rt delays this discharge. As long as the time between pulses does not exceed this delay time, the Time relay will remain operated throughout the pulse sequence period.

If the Auxiliary relay is pulsed twice, the stepping switch will be advanced to point 2. When the Time relay releases, current will be supplied to point 2, energizing Digit 1 relay which will lock through its lock contact. Three more pulses will advance the stepping switch to point 5, operating Digit 2 relay. Four more pulses will advance the stepping switch to point 9. Current will be supplied from point 9 through the contacts of Digit 1 and Digit 2 relays to the Operate Relay, which will lock and remain locked until released by the Release switch. The operate relay, and any relay connected in series with it will restore the unit to a standard receiver. Current will also be supplied through the contact of the Operate Relay to the Home relay which, when operated, will unlock Digit 1 and Digit 2 relays and energize the Reset magnet of the Stepping Switch. As soon



Rear view. The stepping switch is seen on the near left hand corner of the chassis, next to the selenium rectifier.

the wiper has returned home, the Stepping Switch contacts will release the Home relay, thus restoring the unit (except the Operate relay) to its home position.

There are two possibilities if the pulses are not sent in the proper sequence. First, if the stepping switch wiper stops on a point other than #2, 5, or 9, the Time relay, when it releases, will supply current through this point to the Home relay, thus restoring the unit to its home position. Second, if the stepping switch wiper stops on point #5 or 9 (such as five pulses or nine pulses in sequence) the wiper will remain on this point but the Operate relay will not operate because the wiper did not pause on point 2. To insure that the unit starts from its home position, one pulse is supplied previous to operation. One pulse will always insure the unit is starting from its home position. *The calling sequence thus become 1-2-3-4.*

Variable resistor R9 permits a small amount of bleeder current through the plate relay thus increasing its sensitivity. Adjust this control just

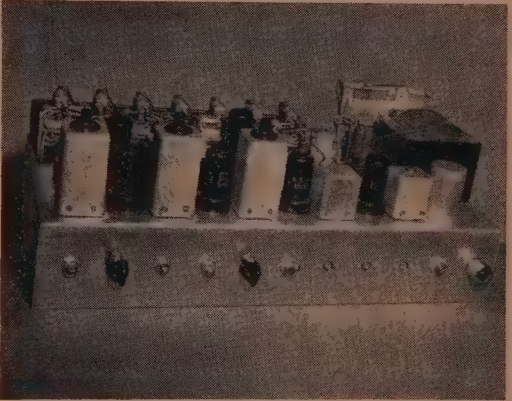


Since a transformerless supply is used to power the relays, there is no electrical connection between the control circuit and the chassis.

below the point where the plate relay will unoperate.

Receiver Requirments

It was found that the selectivity of the receiver should be about 15 kc wide. The first receiver used 2830 Kc IF's (ARC-5) and functioned satisfactorily. An AC/DC type receiver was also tried but was not too satisfactory because there was an interaction between the receiver and pulse unit—making and breaking current on the relay contacts caused clicks in the receiver. A super-regenerative receiver worked, but was not sufficiently selective for practical use. Adding r.f. stages to narrow it required as many tubes as a super-het, and in addition the super-regen created so much interference that it was impractical to operate the regular station receiver at the same time. A suggestion for a first unit would be a simple mixer, two stages of IF, diode detector, noise limiter and the audio circuit shown.



Front view. Since the unit is designed for fixed frequency operation, calibrated controls are not required.

Results

Experience has shown that the unit can be operated under quite adverse conditions. The receiver signal needs be only about readability three but the mobile station *must stop* to transmit the signal under these condiions. Even with signals of good readability, the usual rapid QSB of mobile signals will cause a pulse to be missed. To insure operation, the mobile operator should stop, give the signal, change his location slightly and give the signal again. He should continue this until the fixed station has answered.

Admittedly, the range and reliability of the system could be improved by the addition of such features as tuned filters at the receiver and a stable tone generator at the transmitter. A polar system, such as is used in radio teletype equipment, is still another possibility. However, since the system described imposes no restriction on the transmitter, it offers maximum flexibility; individual calling can be added at any time by varying the pulse sequence used.



Conducted by LOUISA B. SANDO, W5RZJ*

EVER HEAR of operating "dog-mobile"? Well it's been done, and a couple of YLs were the operators. Last February in Fairbanks, Alaska, the Arctic Amateur Radio Club entered in the local Ice Carnival Parade a dog sled mobile station. The club members built the dog sled, involving many days of hard labor, and the battery operated rig to go in it. Then they located eleven white Siberian huskies that had been trained for parade work. All this assembled, they had to choose an operator to ride the sled. Lucky one was KL7ZQ (now W7OYY), Lucille Spargo, and giving an assist while walking along beside the sled was KL7ZR, Rose Cowles. In addition to the white sled (decorated with tinsel and carrying the club call KL7KC) and white dogs, both girls wore white fur parkas. They made many contacts with the "dog-mobile" and, with their 11 watts, were heard as far as New York. "A very colorful sight," adds Lucille, "and I think it was the biggest moment of my life!"

Lucille and her OM, by the way, were stationed at Fairbanks for two years. Presently at Great Falls, Montana, they live on the Air Force Base in a 31-ft. house trailer. Now Class A, W7OYY is on all bands with their new 32V2 and an NC183.

YL's in EA

Lilia de Yebenes, XYL and 2nd op. of EA4CR (ex-EA5BE), mentioned here some time ago, writes: "Did you know that we already have some licensed YLs in Spain? The first one was EA3GE, Elisabeth Van Jess de Torrens, who passed the exam together with her OM, EA3FR. She is from Venezuela, but her OM is Spanish, and they live in Barcelona." Lilia goes on to say, "We went to the IARU 25th Anniversary meeting which took place in Paris on May 18th. I enjoyed that beautiful city a lot. What happened to the Ws? They were missed there."

While not in time for the May meeting, one W YL, at least, did get to Paris this summer, and to a lot of other cities and countries as well, visiting several YLs on the way. Many of you had cards from her, or a QSO from the DX side, so of course you know we're talking about W3CDQ, Liz Zandonini. Her travels sound so interesting you'll surely want to hear about them, so we'll quote from her letter:

"Mrs. Briggs (XYL of W3CAB, deceased, and a member of the ham fraternity for about 30 years) and I left the States July 1st on the *Queen Elizabeth*. Landed at Southampton July 6th and got to London that same p.m. The next day we went sightseeing and the following day visited G2JK (who had been in the States in '48) and his family. He had a party for us and invited quite a few hams to meet me. Around 11 p.m. that evening (his time) I contacted W3WV, W3PZA, W3KDP, W3IL, W3FMC, and I understand many others called me, but I went to bed at 2 a.m. after having had a busy day. G2JK took us touring the next day to Stonehenge and Salisbury, and the following day I went to visit Nell, G2YL, and in the evening met Meg, G3ACC. Nell, of course, I had met before, but Meg was a newcomer to me. She is a very interesting person and is very enthusiastic about ham radio. She was having a committee meeting of the local radio club to discuss their annual dinner so I met a few hams.

"From London we went to Holland—The Hague, Amsterdam, Volendam, and Isle of Marken. Didn't look up any hams because we were quite busy with sightseeing. From Holland to Brussels, Belgium. Here I had written to ON4LP, whom I had contacted in April. He was on hand to meet me and took me to a UBA radio club meeting. Here 30 hams signed my QSL card. They meet in a cafe and each one coming in orders something to drink. Then they gather around the QSL manager, get their cards and form little groups for rag-chewing, adjourning about 11 p.m. ON4LP kept a sked with W3WV and made a sked for the next p.m. for me. Mrs. Briggs and I went over to his shack and worked W3WV and several others. Next day we went to Antwerp to meet ON4AW, whom I had known since 1938.

Several days of sightseeing in Brussels and then by bus and train to Luxembourg and Basle; then by bus to Montreux. There is the place for me—the lake, the town above it, and the mountains behind that. Saw the Castle of Chillon, went up to the mountain top by cog railway and took several boat trips on the lake. Our hotel room had a balcony which overlooked the lake and the mountains—what a beautiful sight!

"From here to Interlaken and the Jungfrau and Trommelbach Falls. From Interlaken to Lucerne via most beautiful mountain roads through the Grimsel and Furka passes. We saw the Rhone glacier—in fact, went into a part of it; it was ice blue. Stayed at Lucerne for three days. Here we bought Swiss watches, music boxes, handkerchiefs, etc. Then to Oberammergau, in a very peaceful valley among the mountains, where the

* Send all contributions to Box 35, Jemez Pueblo, New Mexico.

Passion Play is given, all the villagers taking part. In the mob scene 1400 people are on the stage. The play is given in what looks like a large Quonset. It seats 5000, but usually there are 6000 attending the performance, which lasts from 8 a.m. to noon; 2-hour lunch, and then from 2 p.m. to 6 p.m. Our tour (28 people) was divided up and we lived with the town's people for two days and nights. The houses are filled with beautiful paintings of different phases of Christ's life. We stayed with the lady who played the part of Mary Magdalene in 1930 and 1934

"From here to Bolzano and Cortura d'Ampezzo, where our hotel nestled in the Dolomite mountains, then by bus to Venice. Here we did our traveling by gondola—most interesting. Our hotel was on a canal and just off St. Mark's Square. Did the usual sight-seeing on foot and in gondola, including a ferry boat trip to the famous Lido Beach, and bought Venetian glass, laces and mosaics. Had some good fruit and cheese here and our first spaghetti.

"I left the tour here for Milan where an old ham (1921), IIER, met me. We had some QSOs from his place. IACD also came over and took me around the city, and to Lago Maggiore on the Swiss border where I took nice boat trips on the lake to Isola Bella, Stresa, and other small towns. On market days these are most interesting for native work such as baskets and crocheting is brought in to be sold.

"Went to visit some relatives in Bressia; then to Rome. The city was crowded with pilgrims from all countries, including many U.S. visitors. Went sightseeing and also attended the general audience the Pope had that Wednesday. The audience is usually for an hour, the Pope welcoming everyone in four different languages.

"In the p.m. IIBBL (whom I had QSO'd) came over to meet me. We went to his place, but found the 14-mc. band dead. We did QSO some locals on 10 phone. Next p.m. visited IAPA and IIOJ. All were quite astonished at my perfect Italian—almost as fluent as my English! Back to Milan, then to Florence. Ada, IIMQ/YL, whom I QSO'd from IIER, came to Milan August 16th to meet me. We had only six hours, but made the most of them.

"Left Italy August 18th for Paris. We went sightseeing, shopping, etc. G2JK and his XYL flew from London and had the weekend with us. Did the river clubs, etc., and on the 23rd sailed on the ship arriving in N.Y.C. August 28th. Holiday; took about 20 rolls of 8 mm.

"Enjoyed meeting Meg and Ada and seeing Nell again, and meeting all the OMs. It was a thrill to hear the W stations rolling in R9, and usually getting reports saying, 'I know you—hi!'"

Ada reciprocated 3CDQ's feelings for in a recent letter she commented, "You can't imagine how much joy it gave me to meet Liz and know her personally even though we were together only a little time." IIMQ goes on to say that their little rig is always the same: 6L6, 807, with 15 watts input. But with this she and her father have worked 106 countries for DXCC and 26 zones toward WAZ.

YLRL Activities

Big doings for the YLs (and the OMs) in February are, of course, two days of operating in the YL/OM Contest. You had the details in January CQ, and they are in the current issue of *Harmonics*, so we won't repeat them here. Remember the dates, Saturday, February 24th, 6 p.m. EST, to 11:59 p.m. EST Sunday, February 25, 1951. Any and all licensed OMs are eligible to participate; YLs must be members of the YLRL. Don't forget to send your logs, regardless of score, to W8UDA not later than March 3, 1951. At best the YLs will be far outnumbered by the OMs, so let's all get in there and operate.

20-Meter Phone Net

Because of the unpredictability of 10 meters and with so many of the YLs now Class A, it was decided to start a YLRL net on 20 phone. The net meets on Thursdays at 2:00 p.m. EST, 14,240 kc. with W3UUG, Miriam Blackburn, and W9ILH, Carrie Jones, as NCS. Procedure: NCS will call roll of members, followed by call for new members who would like to report into net. As members report into net they will give the NCS the frequency on which they expect to operate, as well as giving any news about themselves for *Harmonics*. After reporting in, members should QRX on net frequency to hear any YLRL news, then carry on their QSOs on their own frequencies. Here are some of the YLs who checked into the net during November: W2BNC, W2WBN, W4HWR, W4LAS, W4QBY, W5DRA, W5LGY, W6NAZ, W6NLM, W7FTX, W7HDS, W7MUT, W8ATB(QBO), W9LRT and, of course, W3UUG and W9ILH.

On the 40-meter c.w. net, W6YYM, Ellen, says: "Look for NCS on the West Coast. It will be between 7200-7300 PST." 33

VHF

UHF

Conducted by E. M. BROWN, W2PAU*

THE MONTH OF DECEMBER, 1950, seems to have come and gone without producing any v.h.f. headlines. But things have not been completely quiet on the bands—far from it! Six meters rewarded its patient followers with several scattered openings of the auroral and sporadic E type. One of these, on December 21st was unusually extensive for this time of year. Covering the entire northeast-to-southwest section of the country, signals were so strong that W9ZHL was able to work close to a dozen stations ranging from Maine to Texas. This, as such, isn't unusual, but Charlie reports that signals had a tendency to fade a little, perhaps due to the *lack of an antenna* on his end! You see, a recent windstorm knocked all the antennas off his 90-foot tower, and W9ZHL was receiving and transmitting on the remnants of the feeders alone! Maybe this story will help to prove that the old six-meter band still has some life left in 'er.

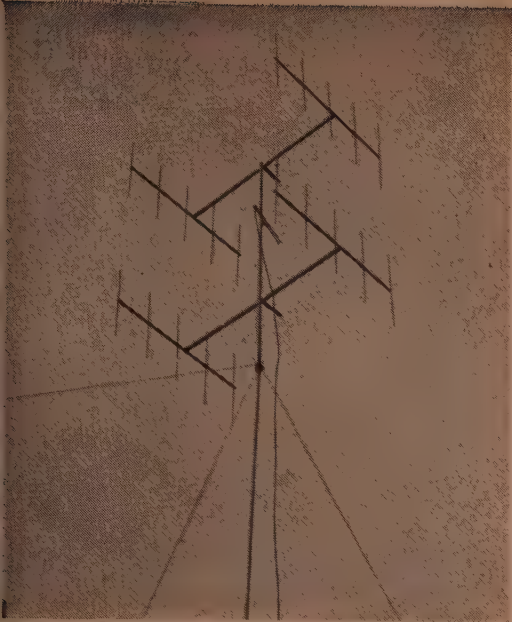
Speaking of windstorms, our file of sad stories about the big blow of November 25th continues to grow. Among the victims of the storm are many more prominent members of the v.h.f. fraternity than we were able to list in our brief review last month. W1SF of Branford, Connecticut, lost his 32-element array that "opened" the band so many times during the past years. W1RQ's double-twin-five came down. W1HDQ lost his 144 mc and 50 mc arrays but we understand that he has them back in operation now. W2BAV's losses were more serious than we had realized—in addition to the aerial equipment Bill lost his tower, shack, and most of the power lines which were so laboriously rigged up the mountainside. That was, indeed, a real blow. Official Weather Bureau figures show that the wind hit over 100 mph in New Jersey.

fringes of the centers of activity shouldn't lose hope. There'll be plenty of bigger and better arrays aimed your way in a few more weeks!

And good ground-wave conditions do come along during the winter months—not as often as in the summer, but often enough to warrant checking the band whenever you get a chance. For example, on December 29th, the weather turned warm (it went above freezing for the first time in over a week!) and we had a first-class opening to the South, with solid 'phone signals over the 200-mile-plus path to Richmond.

At Cornell University, Ithica, N. Y., a group of scientists have been investigating the problems of radio-wave propagation in the troposphere. They have developed a theory which seems to explain some of the unusual propagational effects which we all have noted on the v.h.f. bands. This theory should be of great interest to the hams—some of its conclusions have a direct bearing on operating practices and antenna design. If these conclusions





WIRO's dual twin-5 was another victim of the storm—but didn't it look pretty while it was still up?

are correct, we may be able to squeeze a little better performance out of our v.h.f. gear by taking full advantage of the possibilities. And amateurs have something to offer the research workers in this project. They would like to get experimental verification of some aspects of the theory. The amateurs, set up as they are with effective v.h.f. equipment, a wide variety of geographic locations, and flexible beam antenna installations constitute a ready-made laboratory set-up to obtain the type of data that is required.

We are privileged to be able to present a brief review of the new theory by one of the men responsible for its development:

A Discussion of Radio Scattering in the Troposphere

by W. E. Gordon*

It has been recognized for a long time that there are some instances of propagation to distances well beyond the expected horizon which atmospheric bending and sporadic E cannot explain. During and shortly after the war, a number of quantitative propagation experiments showed that the theoretical variation of the signal beyond the horizon agreed closely with the experimental results out to a certain point. Beyond this point, the signal refused to drop off as rapidly as the theory predicted. At the time, there was no good explanation for this. Recently an approximate theory describing this phenomena was developed by Dr. H. S. Booker and the author at Cornell.¹ This theory

School of Electrical Engineering, Cornell Univ., Ithaca, N. Y.

explains these results in terms of "tropospheric scattering".

The theory deals with scattered signals alone and it indicates that these signals will always be relatively weak. This explains the fact that the signals measured in the experiments decreased in accordance with the then-existing theory up to the point where they were fairly weak. But apparently the total signal beyond the horizon was made up of the combination of the direct (diffracted) signal and another signal, the so-called "scattered" signal. The scattered component showed up only as random fading until the signal propagated in the "usual way" became smaller than the scattered signal.

The "Blobby" Atmosphere

What is the cause of this scattering? It is apparently due to the existence of turbulent motion in the air. As we all know, the air is not uniform and winds are seldom completely steady, but are frequently accompanied by small but rapid changes. This is particularly true near the surface of the earth where gusts and whirlwinds are familiar. It is also true aloft. Anyone who has done much flying is familiar with the "air pockets" which cause bumpy flights; these are the largest kind of turbulent atmospheric irregularities. They can be much smaller, too. The best way to describe this more-or-less random irregularity is by the use of statistical methods. We know that all these pockets of air of different density (and hence dielectric constant) are not the same size and do not differ from the average by the same amount. Even so, we may consider the atmosphere at some point as having a certain average "blobbyness". That is, we may consider that (roughly) there are a large number of spherical "blobs" of air slightly different from the surrounding air, and these are packed closely together. If we can figure out what these blobs do to radio signals, we will have solved the scattering problem.

Not much is known about the size of blobs to be expected at any given time, but it is known that they exist; and they probably exist in the daytime even more than at night. This means that scattering can be used to explain abnormal ranges worked in the daytime when "ducts" are not likely to occur.

How Blobs Scatter Signals

Each blob acts as an antenna, and signals reaching it from the transmitter are scattered in all directions just as they would be if there was an airplane at the location of the blobs and the signal was scattered from its metal surfaces. Of course, a given blob does not scatter as strongly as a metal object of the same size. If the blobs were small compared with the wavelength, their radiation would have almost the same distribution in space as that of a half-wave dipole. So, for small blobs, we may consider that the signal received by scattering comes from a large number of "dipole" antennas somewhere in the air between the transmitter and the receiver. Each one acts as if it were

1 Proc. IRE. Vol. 38, p. 40 (April, 1950).

excited by a very low-powered transmitter. The orientation of the dipoles is perpendicular to the line connecting them with the transmitting antenna, but they lie in a vertical plane for vertical polarization of the transmitting antenna, and a horizontal plane for a horizontal transmitting antenna. Thus, if we have a vertical transmitting antenna the scattered signal is that which would be received from a number of tilted dipoles in the air, the tilting being such that they are broadside to the transmitter. For a horizontal antenna, the dipoles in the air are also horizontal.

In the case of blobs large compared with the wavelength the effect is that of a number of beam antennas of physical size about the same as the blob size—pointed in the direction from transmitter to blob. If these blobs are fairly high in the air and the blobs are large enough so that their beam-width is small, the scattered beam may miss the earth entirely; in this case we would not be able to receive the scattered signal from a ground station, but would be able to receive it from an airplane.

Effects on Ham Transmissions

What are the implications of this theory for amateur communications? In the first place, scattering permits transmission during the daytime to distances which would otherwise be impossible. It may make such transmission possible at night, particularly over mountainous country. The importance of scattering at night is not likely to be so great because of the fact that some form of tropospheric bending is frequently present at night,

W7QLZ mobile on 430 mc atop Antelope Mountain, near Phoenix, Arizona. Signals at distances up to 100 miles have been unbelievably strong.



and this might cause stronger signals than the scattered signals even beyond the horizon. Nevertheless, ranges might well be extended at night by scattering.

A second point is that horizontal polarization is to be preferred slightly over vertical polarization when scattering by small blobs is the means of propagation. This is due to the fact that the receiver may be end-on to the tilted dipoles when vertical antennas are used. For horizontal antennas the scattering dipoles are also horizontal, and hence the receiver antenna is always broadside to the

A third interesting point was brought out by experiments at the University of Texas on FM broadcast stations. It is that there is an optimum angle at which to tilt the receiving array for a given blob size. In some of their experiments this was as high as 30 degrees above the horizon. It may actually be possible in some cases to receive a better signal by pointing the antenna straight up (with proper polarization direction) than by pointing the antenna at the horizon! For the receiver DX however, an antenna pointed toward the horizon may be just a little low, but it is probably the best for all-around work. It should be borne in mind that these statements refer to scattered signals alone. If some other type of propagation predominates, we actually want to *minimize* the scattered signal, since it be a cause of fading.

A fourth point deals with the rate of fading. This rate is directly proportional to the speed of the blobs and inversely proportional to either the size of the beam antennas used or the blob size depending on which is bigger. For high wind speeds and small antennas this fading rate may be several cycles per second. This may explain some of the "wavery" faint signals so often heard on the v.h.f. bands.

It seems likely that the six-meter band and a higher frequency bands will be affected by this phenomena. Incidentally, the higher the frequency the better, until that frequency is reached beyond which the receiver is out of the "scattering beam."

Not much is known about the size of blobs likely to be found nor about their distribution with altitude. The meteorologists think that blobs of the order of meters in size should be probable, but they don't really know. If more radio information becomes available it may be possible to tell something about the blob size from it, but there seems little chance that the meteorologists will measure the blob size directly. Amateur observations would be a big help in determining such information.

Editor's Note:

Measurements made on any of the v.h.f.-u.h.f. bands would be valuable. If simultaneous observations could be made on more than one band it would be especially interesting. Any ham, acting as an individual, can make useful observations. All that is required is that measurements of signal strength and direction of arrival be made on signals from other stations—which can be using any type of transmitting equipment (although it would be nice to obtain data on power, type of antenna, etc.

(Continued on page 40)

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| 416 438 479 503 | 394 | 405.377 | 387 | 526 | 537 |
| 418 440 481 504 | 394 | 405.379 | 388 | 529 | 538 |
| 419 441 483 506 | 395 | 408 | 380 | | |
| 420 442 484 507 | 396 | 409 | | | |
| 422 443 485 509 | 397 | 411 | | | |
| 423 444 487 511 | 400 | | | | |
| 424 445 488 516 | | | | | |
| 425 446 489 519 | | | | | |
| 426 447 491 518 | | | | | |
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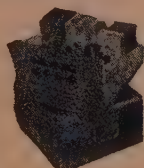
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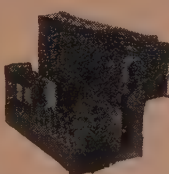
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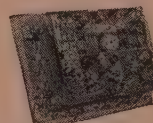
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W. W. PURVIS, W2BK*

(Any similarity to persons livin' or dead that is mentioned in this here is purely on purpose, so I am keepin' my name secret, so's nobody gits wise. Otherwise, I'm a dead pigeon.)

AT the close of world war figger two, (I always gotta say *figger* or *number* when speakin' to rayo hams because most is so dumb they can't tell when two is a figger), I bought some war surplus rayo junk and built a powerful sendin' set with which I expects not only to git on the air in a big way, but stay on there. I hadda little set before the war without hardly no power a-tall, but now I has over 7 hunnert watts an a beam that I figgers could drown out all the hams on my fregussy, just like a rich guy. Boy, what terrific power I'm gettin'! I'm lightin' up bulbs all over the joint that is turned off. Not only was I causin' interference to television and rayo programs, but was bein' received in good condition on all telephone lines around the place. A neighbor said if I din't quit burnin' her cellar lights, I'd have to pay her leckdrift bill.

Well, okay, things is workin' fine; so I starts in rastlin' with a telegraph and goes on the air usin' dots and dashes. I bangs out CQ letters for half an hour and never got no answer. I gits hold of a machine that sends CQ out automatic, and I left it run sometimes while I had tea an then would just make a couple of call letters and turn on the rayo receiver. Nobody never called me, but I din't give up. I tries to figger out what's wrong. Maybe I ain't callin' long enough or something aint workin' just right.

Listenin' in to the rayo set at first I din't hear nothin' but special calls. Some hams was callin' CQ, but mostly it was rich guys callin' for dx. I hears one guy callin' CQ for zone 8, but there aint no postal zones in my town, so that left me out of the pitcher. Others was callin' CQ for SS (meanin' seamship no doubt), and for CD, AD and stuff like that. (Never did find out what them letters was about). One fell' was gittin' Australia, but I don't know if it was direct. I heard him tell Australia how conditions was very bad over here. The guy musta been out of work and hungry, because if he was talkin' to Australia he couldn'ta

meant that rayo conditions was bad. If rayo conditions was that bad, who would he talk to with good conditions? Planet Wolfe 369?

After many hours of cussin' and sweatin', I contacted a guy that was callin' for CD. He was mad! He called me a OC, whatever that stands for. I ast him, I says, "What's CD?"

"See page 50, January QST magazine", he says.

"Aint got no QST", I said.



"Okay," says the guy, "You are welcome to join us anyways".

"Where at?" I says. Just then a bunch of guys flocked all over the fregussy an I couldn't hear nothin'. Gee, I wonder what that CD means. Could it mean they was havin' chicken dinner somewhere?

Boy, that ham stuff is terrific onced you git onto it, and I think I was gittin' onto it pretty good. I'm beginnin' to git guys up to three blocks away with no trouble; and don't think I didn't appreciate their weather reports. One guy was kind enough to tell me that our town is 8 miles from Georgetown, which I had knowed all the time. I told him I lived in town for many years.

"Glad to hear it", he says, "Georgetown is 8 miles from here". Next he says, "Best regards, see you later, gotta git off the air right away and take out the wife".

I was beginnin' to figger maybe them hams didn't have time to say nothin'. I found out it made 'em happy if I wished 'em good luck in the contest. Of course, I didn't know there was no contest, but they seemed tickled at what I said, so I latched onto that idea of bringin' them joy. The fregussys all over the dial was cluttered up with thousands of guys all

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The Jefferson-Travis Model 52, 5 watt Marine Radio Telephone, has been specifically designed to provide radio telephone service on sail boats, small power boats and other craft with no electrical installation or where it is not desirable to use existing power. This unit would also be desirable for the amateur 75 meter band for mobile or portable operation.

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These units were manufactured and made to sell for much more than our asking price. From reports and information obtained by E.R.C. before the purchase of these sets, we were told that they are operating from 35 to 50 miles off the coast to shore stations or between other craft. We were not fortunate enough to obtain a large quantity of these units; therefore, rush your order to assure your purchase of one of these excellent bargains. This is brand new factory-packed merchandise.



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LETTERS

(from page 6)

It's also worth mentioning that most of the BC-221s were machine calibrated, and should be painstakingly hand-calibrated if they are to be used for any really important fine work. Anyone who has the patience to do this as I did will also discover that there is some small eccentricity in the engraving of the dial divisions, and perhaps a little bit in the worm, too. These show up as a slight waviness in the line, when a graph is plotted on a large enough scale. The eccentricity in many of the dial markings can easily be seen by carefully checking the ends of the markings against the vernier scale at points 90 degrees apart on the main dial.

It's worth mentioning also that the BC-221, while good, is not exactly one of General Radio's Primary Standards, although quite a few hams seem to regard it as such. Even with regulated plate and screen supply, line voltage changes will cause some frequency drift in both the crystal and variable frequency oscillators. Correction can be readily made to both of these, of course.

Add to that the fact that the unit can be seriously affected by proximity of objects to its incompletely shielded under side, and you're fairly well in the clear, providing reasonable precautions about large thermal excursions are observed. The trouble with objects proximate to the poorly shielded under side is one I discovered while half way through a very tedious calibration job. Several pots of coffee later, I had the answer in the form

of a carefully cut and folded aluminum shield over the entire bottom....after which complete recalibration was necessary.

L. Jerome Stanton, W2WHM

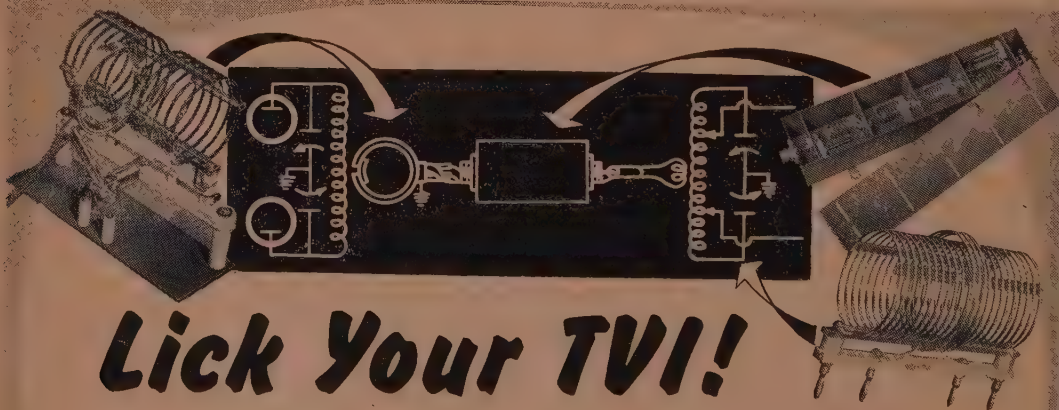
ITV and TVI

139 Gunckel Ave., Dayton 10, Ohio

Editor, CQ:

I am glad to hear the CQ staff is analyzing the problem of ITV and the corrective procedures. Harmonics from the horizontal oscillator are definitely a problem even out here in Ohio, although I imagine the situation is even worse in New York and the larger cities. The harmonics are quite strong down in our eighty meter band and even in the higher frequency bands. You are no doubt also aware of the interference which shows up as a strong background noise on 80 meters. I believe this is caused by the video amplifiers in neighboring TV sets. We should do everything possible to get to the bottom of this problem, as many other services are also affected. I will look forward with interest to any articles on the subject in CQ. In this locality the most severe type of interference to TV reception seems to be local oscillator radiation. Although we are 55 miles from Cincinnati we get good reception from their Channel 7 and 11 stations and since sets use both low and high side local oscillators you can readily appreciate the problem. Naturally, amateurs get blamed for this interference many times.

I personally believe too much emphasis has been placed on harmonic interference. At least every ham seems to want to approach TVI at his transmitter first. If he has an unshielded transmitter I think of course that it is well to put it in a



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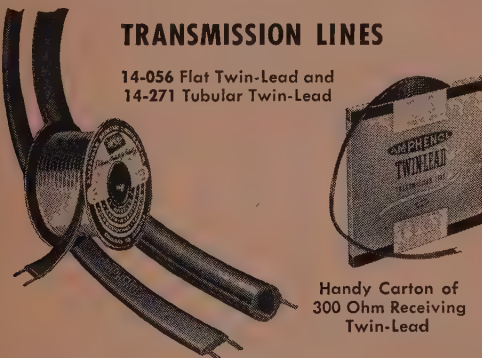


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cabinet and use a filter in the transmission line if the transmitter is of old design. But in the majority of cases, the complaints are usually due to fundamental overload, etc., and a good high pass filter properly installed at the TV set will do the trick. Any interference left is usually due to harmonics, but is really amazing the number of complaints that are cleared up with only a high pass filter, plus a filter (needed only in very stubborn cases) in the AC line (two Sprague 48P9's). It should be kept in mind that fundamental trouble does not always show up as overload affecting all channels. In many cases, only the weaker stations are affected, especially when harmonics of the fundamental are generated in the RF or mixer stages of the TV set.

J. F. Skelton, Chairman TVI Committee, Dallas Amateur Radio Club, 704 Interurban Building, Dallas, Texas concurs in my thoughts on the importance of emphasizing fundamental troubles and their cures as there are too many amateurs staying off the air when a high pass filter at the receiver could get them back on.

The amateurs in Dallas have done an outstanding job of tackling the TVI problem down there. They prepared a mailing and sent it to all TV dealers and service shops in Dallas; this mailing and a later follow-up was sent to all amateurs. I would suggest that other clubs write to him for copies. They cited many case histories.

Going back to ITV, have you ever listened on 4.5 Mc? The hash at this frequency is bad, apparently caused by the IF's of intercarrier sets. Luckily it doesn't fall in a ham band.*

Clem E. Wolford, W8ENH

*Editor's Note: A bad case of 4.5 Mc radiation bothered a communications channel on the West Coast last year; with FCC and the Military authorities in on it, this case was tracked down and suppressed pronto.

VHF-UHF (from page 40)

of the station on the other end of the circuit). Measurements should be taken on stations at various distances, under varying weather conditions. These measurements might be accomplished by the use of an antenna which exhibits high directivity in the vertical plane, and "scanning" the pattern vertically by tilting the antenna for maximum signal strength. If the antenna is mounted fairly high above the ground, and if the angle of arrival of signals exceeds about ten degrees, we figure that good measurements could be made with the types of two-meter arrays commonly in use today. Nothing special, except means of tilting the antenna, would be required.

Checks on the effects of polarization would also be interesting, especially at relatively short ranges, where the effects of polarization should be most marked.

Tests should be made over paths sufficiently long that the normal "ground wave" is weak. The most interesting tests should occur under conditions when normal DX conditions are poor.

We are certain that some of our readers will be sufficiently interested in the results of this program to cooperate in making observations. We suggest

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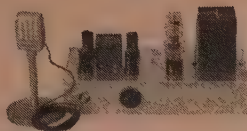


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*For external local oscillator add \$5.00 to above prices.



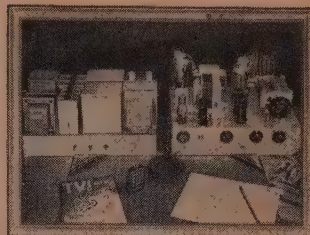
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that you contact Mr. W. E. Gordon of Cornell University for advice on the details of any experiments you may have in mind.

Sunspots

While we're on the subject of propagation, here's a note for the fellows who are more interested in ionosphere work. The trend of sunspot activity is falling off even faster than predicted. At the end of 1950 the index of sunspot number had agged to the point where it looks as though 1951 may be about similar to the period from 1942-1945. (But let's hope that ham activity is a lot higher than it was during that period!)

What does this imply for the v.h.f workers? It probably means that the occasional F-layer DX which was encountered on six meters during the past three years will not be experienced until the sunspot activity returns. The frequency and intensity of auroral openings will probably be reduced. It looks now as though 1950 was the peak auroral year. What about sporadic E? There seems to be some controversy in this matter. G6DH claims that the MUF during E_s openings is higher during periods of peak sunspot activity, although he admits that the number of E_s openings seems to be more-or-less independent of sunspot activity. Perry Ferrell will be in a better position to confirm or deny this thesis after a few months of low sunspot activity!

More on Beacon Transmitters

The value of "beacon" transmitters—continuously-

operating constant-frequency automatically-keyed signal sources—has been amply demonstrated during the past season on six meters. Several instances have occurred where beacon signals were the only signals heard during band openings of short duration.

We might as well face it—for some reason or other the present denizens of the six-meter band seem to be reluctant to do much transmitting unless conditions appear unusual. There is no doubt that they devote plenty of time listening on the band—the high activity during band openings proves this. Several of the boys use automatic "band-scanning" receivers. A calling frequency (50.1 mc) has been established to simplify searching for signals. But none of these measures provides signals for the waiting listeners to detect! Whether it's due to TVI or a natural reluctance to clutter up the band with useless CQs, there's a sad lack of signals on the band. Which is where the "beacons" come in.

The Canadian Government has established a beacon operating just outside the low end of the six-meter band. This rig operated under the call of VY6R for several weeks, but the call has been changed to VE9RB. (Due to keying troubles, this rig has occasionally been reported as VE9RD).

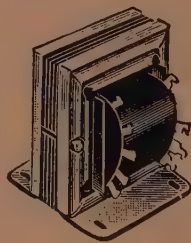
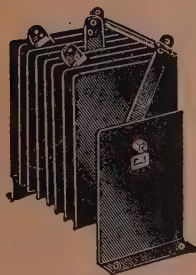
W9MBL, of New Castle, Indiana, was the first American amateur to establish and operate a beacon on a regular basis. His signals, on 50.1 mc, have been the first to break through on band openings time after time. The six-meter gang owes

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INSTALLATION DATA

Select proper rectifier and transformer from table for your specific application. After proper selection has been made proceed as follows: Connect secondary terminals of transformer to yellow lugs of rectifier selected, connect black lugs to NEGATIVE input terminal of dynamotor, connect red lugs to POSITIVE input terminals of dynamotor. No changes in switching circuit of dynamotor are necessary if cables are included or cable are to be used with unit. Provide "on and off" switch in primary of supply transformer. Rectifier output can be connected to any dynamotor giving good regulation.

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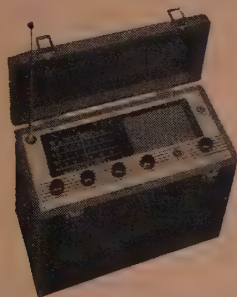
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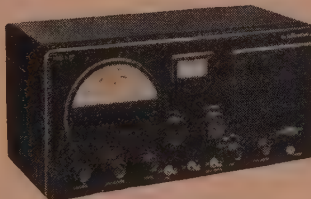
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98F007. Wt., 77 lbs. NET. \$289.50



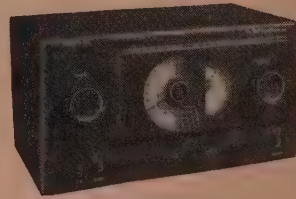
S-72 ALL-WAVE PORTABLE

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G6M60. Battery Pack, 7 lbs. NET \$4.17



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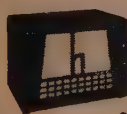


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BEST

Ken a vote of thanks for his persistence in this project.

Now, several other U. S. hams are seriously considering the operation of beacon transmitters. W5AJG of Dallas is almost ready to fire up. W6WAI was ready, but has temporarily suspended operations due to a de-TVing program. W7EVO would like to put his Navy-surplus TBS on the air as a beacon. W4LAW and W8BFQ (yep, Marge has put in an appearance on six meters) also are interested.

It is important that the efforts of the beacon operators be coordinated to derive most benefits from the program. Perry Ferrell, head of the RASO project, is in a good position to tie together such considerations as operating schedules, frequencies, etc., so we would strongly recommend that you check with him before firing up a beacon rig. Perry also warns, wisely that the thing could easily be over-done. There is no need to have more than one beacon in any particular geographical area. But there are still some sections of the country where a beacon would be most welcome.

Notes from the Mail Bag

W7QLZ reports that he took his mobile 144 and 435 mc equipment up to the West Rim of "Bloody Basin" about 80 miles from Phoenix on December 10th. He worked W7FGG and W7NVN in Tucson, and W7YZC in Phoenix on two meters with strong signals. Switching to 435 mc, contact was re-established with W7YZC, still with S9-plus signals! W7FGG was able to copy Clyde in Tucson, 175 miles away, but they couldn't quite make it a two-way. However, W7QLZ is encouraged, for as he puts it, W7FGG has about the worst location in Tucson! W7QLZ also reports that conditions have been pretty poor on two meters during December, the period from the 10th to the 17th the worst ever. Couldn't even copy the signals from Tucson!

XE1GE recently acquired a new 8-element two-meter array. Hope that Jeff can find someone to work on two meters around Mexico City. We could use a two-meter outpost down that way next summer!

W2ZGP will be operating at Ithica, N. Y., on 50.05 mc between 1630 and 1830 EST on a regular basis—main object, to observe aurora effects. Ken will attempt to transmit on the even 1/4-hour intervals. He would like to line up a few stations that he could schedule on a regular basis. He will especially monitor 50.1 mc. (The calling frequency—remember?)

DL4CK sends in a letter packed with news about the activities of the v.h.f. experimenters in Germany and the surrounding countries. We'll have to post-pont most of the new due to lack of space. But Jack would like to have us spread around the word that he will be running test transmissions on a regular basis, from Wiesbaden, every Saturday night. The following schedule will be kept: on 144.74 mc, using both cw and voice modulation, at 2000 GMT toward Stuttgart, at 2100 toward Berlin, at 2130 toward Luxembourg and Paris,

at 2200 toward Bremen and Hanover, and at 2230 GMT toward Munich.

G5BY reports that he has little fresh news about 435 mc operations—only one 119-mile contact during December. But he has been busy improving his receiver. Hilton's modifications to the ASB8 should be of interest to anyone owning one of these receivers. He has added an extra tuned co-axial line to the input circuit to permit feeding the input with balanced open-wire feed line. The 955 mixer was replaced with a crystal-diode mixer. The 8 mc i.f. output of the mixer is fed to the communications receiver through a 6AJ5 i.f. amplifier. The 955 u.h.f. oscillator was scrapped, and an external oscillator (1/2-6J6) now feeds into a frequency-tripler stage mounted on the ASB8 chassis. Hilton claims that these features all work very smoothly; in fact, the rise in noise when the light-house tube r.f. stage is peaked up is about the same as is experienced on two meters when the 6J6 pre-amp of the two meter converter is peaked!

Summary of Six-Meter Conditions

The first few days of the month were remarkably quiet. On the 12th a minor auroral opening was reported by VE3AET. The disturbed conditions persisted until the 13th, and VE3AET worked W2MEU and heard several other signals. W0AEH heard W0QIN at 2000 EST. On the 14th a sporadic E opening hit the eastern section of the country, with W1s LLL, GJO, HDQ, LJ; W2s MEU, BVJ; W3OAS; W4LAW and W4NUW

and others active.

A few minor openings were reported for the period from the 15th to the 20th. On the 20th conditions seem to have been good over a wide area, but not many QSOs were made. W5AJG, W4LAW, VE5NC and W0UMQ were known to have been in on this opening. On the 21st, from 1850 to 2034 a real bang-up opening took place, with plenty of stations active. The list of stations worked by W9ZHL without his antenna, is typical: W1PWW, VE3AET, W5s QME, DSB, ONS, FXN, BDT, AJG, W8CMS, etc. W5AJG worked several 4s, 8s, 3s, and VE3s. In short, it was good!

We have too few reports of two-meter conditions to present any sort of a summary of activity on this band during the past month. But we do know that there have been several un-scheduled openings that have produced flurries of activity in widely-separated parts of the country. So don't give the band back to the Indians and the rag-chewers just yet! Stick around and get in on the fun.

And don't forget that we still have the problem of Civilian Defense to contend with. Although there are a lot of questions left un-answered at this time, it looks as though we may get a chance to demonstrate how well our v.h.f. facilities can serve in time of need....

That's about the works for now. . . Keep us posted on activity and conditions in your neck of the woods, and we'll do our best to pass the word along!

73, Brownie, W2PAU

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| BC-454 | Receiver 3-6 mc. | 3.95 | 7.95 |
| BC-455 | Receiver 6-9.1 mc. | 6.95 | 9.95 |
| BC-457 | Transmitter 4-5.3 mc. | 3.95 | |
| BC-458 | Transmitter 5-9.7 mc. | 3.95 | |
| BC-696 | Transmitter 3-4 mc. | 12.95 | |
| BC-433 | 200-1750 kc. Receiver | 19.95 | |
| Above all with tubes. | | | |

| | | | |
|----------|---|-------|-------|
| BC-1206C | Receiver 200-400 kc. | 5.95 | 7.95 |
| BC-357 | Marker Beacon Rec. W.O. Tubes | | 3.95 |
| TA-12 | Transmitter | | 39.50 |
| BC-733 | Excellent condition | 9.95 | |
| BC-375 | Transmitter 100 Watt Voice, CW, MCW, covers frequency range 200 kc to 12 mc by the use of Plug in Tuning Units, as listed below, Complete with tubes, less Tuning Units | 15.95 | 19.95 |

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| PE-94 | For SCR-522 24v. | \$4.95 New |
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| BC-348 Mounting Base | \$2.49 | BC-348 Outlet Plug | \$7.69 |
| RG-7U Coax | 97.5 ohms | | .06 ft. |

GP-7 NAVY TRANSMITTER—100 watt master oscillator type. Can be used on any freq. from 350-9050 kc. by using proper plug in tuning unit. Type 803 P.A. and built-in, 115 V. 400 cy. power supply using a pair of 1616 rectifiers. Comes with 3000-4525 kc. tuning unit. . . \$12.50. Additional Tuning Units Ea. \$3.50

Many More Items too numerous to list. Inquiries Invited.

Hams Provided Link In The Korean Crisis

Radio amateurs serving with the U.S. armed forces provided a major communications link in the first hours of the Korean fighting, reports Morton E. Millikan in *Stars and Stripes*. JA2DD, JA2KK, and JA2MA formed the backbone of the Japanese end of the net that kept traffic flowing in and out of Korea during the first hours of the crisis, furnishing the sole direct link to Pusan and Seoul.

HL1CD, Pusan, the first participant in the emergency, was contacted to clear the Pusan airfield after regular aircraft communications had been cut off. With HL1US in Seoul they maintained a vital direct link to MacArthur's headquarters in Tokyo during the first 48 hours. For 31 hours the critical communications line to Seoul was held open on 20 meters until the advancing Communist armies forced the two operators to destroy their rig with hand grenades and barely catch the last plane out.

After the first few hours, American hams in Tokyo organized into monitoring parties to scan the bands for any activity from Korea. This watchfulness was rewarded late Sunday evening of the fateful week when JA2DD heard HL1CD calling QRRR on 20-meter phone, while JA2KK was holding the Seoul link with HL1US. Switching to 20-meter c.w. (HL1CD had haywired together a 20-watt rig), they held a second vital contact between

Pusan and Tokyo until regular communications were again established. Operating in the very teeth of the attack, the many operators who helped to hold communications open performed magnificently. Working in shifts, they held the fort during those first hours.

After the situation came under control there were hundreds of personal-inquiry messages from the men in Korea to their folks in the U.S. With W1AW, W7IOQ and many other stateside hams cooperating, these messages were relayed to the national traffic nets for delivery.

Our hats are off to the hams who performed so well during the first critical hours and kept the lines open to Korea.

UP & AT 'EM (from page 32)

many DX contacts. On this band, however, an antenna designed for maximum efficiency would be more desirable.

W1ZL is located at the edge of a salt water harbor in a valley that runs north and south. From a bearing of approximately 220 to 350 degrees, a nearby hill rises abruptly to a height of one hundred feet. Reports from DX stations worked

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in that sector are better by two "S" points when worked via the long path in the afternoon.

You might try the Versatile Vertical for size and find yourself agreeably surprised. What started out to be a jury-rig here has become a permanent installation. It will, however, never take the place of four terminated rhombics!

1 Smith, "Bet My Money on a Bobtail Beam", CQ, March, 1948.

SEEDRICK

(from page 42)

chirpin' away, but soon's I'd git hold of a guy he din't have time to say nothin'. They was all goin' out somewheres or their wives was callin' them to eat, take the garbage out, wash dishes, move the piano and so forth. There is an old sayin' "If at first you don't succeed, give up". Also, "Words is wiser than fiction", and similar, so I quits. I don't care for no dot and dash stuff no-way.

My mod'lotion was workin', so I gits on usin' a mike-a-phone. I couldn't hear no futhern a hunnert miles account of too many guys was all time callin' too many other guys. Most the time



everything was all garbled up mumbo-jumbo that sounded like da stock market.

Ever onced in a while I'd be tunin' the set and hears a ham say, "Standin' by for you".

That's a big break for me! I throws da mike-a-phone on and hollers, "Oh—kay da station standin' by for me. Who is it, and how did youse know I was listenin' in to youse?" I called lotsa times but no matter how hard I tried I couldn't never find out who it was tryin' to git me.

After while 15 guys that knowed each other's names was takin' turns yellin' on the fregussy, callin' round tables. They was a mixture of jerks and wise guys all speakin' like they knowed somethin' terrible important. Most of 'em was tryin' to see how long they could talk without sayin' nothin' that made no sense except "uh" and

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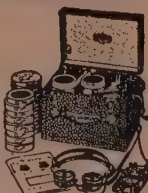
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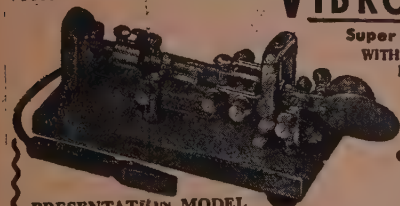
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"and uh". I was settin' waitin' for hours wid my rayo sendin' set turned on usin' up hunnerts of dollars worth of leckdrit tryin' to git a chanced to break in an say what kinda rayo tubes I was usin'. Finally I did git a turn and gives my name. Fell' I know fixed up a notch relay that rung a bell and turned on the set after about 15 guys come on, so all I hadda do was lay in bed and sleep. When the bell rings, I jumps up and yells, with a voice put on to sound important, "Oh—kay gentlemen! We hear your voices clear. Stand by for da next fell'. Over!" Sometimes I'd play smart and confuse 'em with a few numbers which din't mean nothin'. I'd say I was runnin' a 567BW into a 8ZY42 which was walkin' wid 3 blondes on a delta match up 691 gallopin' faze inversion zeppelin; and stuff like that.



Night times I was wonderin' if California could git my signals, when nobody was on. I figgers 'bout 3 am is a good time, because only drunks and looney-ticks is up then; so I gits up and listens. Two guys was on my fregussy, both of 'em in the same town, down south. I feels awful tired and sleepy and wants to git back in bed, but I sits there waitin' figgerin' they'd soon go off an I'd git California. I waited half and hour an they didn't show no signs of quittin'. One dope was eatin' pancakes and the other was readin' a book. While one 'eat, he was tellin' the other how to work a fregussy meter. The other jerk was readin' about flyin' saucers. Each fell' would say he was, "Callin' and returnin'". I could hear 'em callin' and I knowed they was returnin'; but if I knowed *why* they was returnin' I'll bet I could 'limate a lots of television interference. After while I had enough, but instead of goin' to bed I gits real mad and bursts right in on the fregussy callin' for CQ. The dopes hears me and they gits mad.

"Is that yankee botherin' you?" says one dope to the other.

"No," said the other dope, "He aint even gittin' acrossed the Susquehanna River".

Bein' a great great grandson of dat great Southern General, and me a rebel myself, I gits maddern ever at bein' called a yankee, but I din't it on. I was mad enough to think ser'ous of goin' down South and straightenin' them rebs out, but a fell' in Ohio comes on and starts callin' me. With two yanks and two rebels, da civil war was on. We called them dopes everything we could think of from skinflint cotton pickers to hillbilly jaspers. "Holy smokes", I says, "Must be Don Ameche din't install no telephone inventions in dat rebel town there yet. I ast 'em if they needed a nickle or so to call up. I told 'em I'd lend 'em money to telephone so's I'd git rid of 'em and git California. Things got worst and worst! One dope wanted my license number, but I din't had no number, cause I din't have no license.

What happened next was the most wunnerful thing I ever seen! Up in the attic, I has a big water cool tube a fel' stole from a broadcastin' station. I had it hooked up but never used it, account of ever time I throwed it on the lights dimmed all around the place. I throwed on da big tube and yells, "Callin' da state nuts institution, callin' da state nuts institution. Round up 2 loose nuts from da confedrid army that is gettin' violent approachin' from da rear."

Boy, things was really sizzlin'! Da fregussys was blocked for 'bout 3 thousand miles. The aerial was so hot it burned a hole in da winder sill. Sparks was flyin' from da ceilin' up above. People starts

runnin' up and down in da street. Fire engine bells and sirens started up and then there was a loud explosion from da attic. I jumped out da winder, landin' in some poison ivy and was grabbed by two men wid white coats on wearin' some kinda Dick Tracy badges. These guys said dey came from Federal Communists Association and demanded to see my license. Dey said I was boot-leggin'. I don't see how they knowed that! I had a small still in da cellar, but never told nobody and never sold no liquor. Well, anyways, no more rayo for me! My eyes is closed wid poison ivy and I can't see nothin', and my case comes up on Tuesday.

When I gits out of jail an rebuilds my house back, I might be interested in knowin' where I can swipe another water cool tube at.

SEEDRICK

SCRATCHI

(from page 4)

five different stations coming in, one on each antenna, and if signals are so loud, with half-wave antenna should really be picking up a few millivolts of energy. Quick check with neon bulb are making Scratchi looking like piker in estimate. Are being able to draw arcs off most antennas, are getting so much energy. Wow!! Scratchi are now all set for big experiment.

Are next running feeders from antennas to box I are making previous night, then doing some

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tuning of condensers, then running twisted pair from that box to another box, in which are nice tank circuit. Finally are putting another antenna for eighty meter band, tuning it up, then going back and putting good old hand key in twisted lead between boxes. I then fire up my receiver, and toss out a seek-you — look, Hon. Ed., no transmitter!!

Not getting any comeback on first call, but second time I calling I raise a fellow in California and have a nice chat. Are able to talk to cupple more hams on coast before calling it a day. By gollies, Scratchi are really having something. Here are able to having nice transmitter, when not having transmitter at all.

You see, what are doing, Hon. Ed., is taking these five broadcast stations, picking up nice hunk of energy from each on special antenna, then feeding energy from each antenna into box where are having resonant circuit for each BC station. Are then feeding energy from each coil into another resonant circuit, where frequencies of BC stations are adding together. I are picking the BC stations so they all between 550 and 900 kilocycles, so that total frequency is nicely in eighty meter band. Then, with eighty meter soup in tank, are coupling this through twisted pair to another box, where are having antenna coupling network for matching to eighty meter antenna. By keying twisted pair are able to putting eighty meter see-w signal on and off the air. Pretty hots idea, you not thinking so, Hon. Ed?

These are where big joke on engineer are coming in. He are driving over from coast today to seeing what happening and to showing me why what I

saying are happening can't be happening. He are due to big shocking, because it are happening. Of course, what he are not knowing is that he are already proving it can happen, on acct. he are one of the hams I talking to with this system.

So that's how it are now standing. He arriving any moment now. Of course, even I are not figuring out why signals are so strong at that one point on the ranch, and Scratchi are not knowing why all this is working, but, HEE-HAW, it is

Respectively pours,
Hashafisti Scratchi

EXCITER

(from page 16)

of the output line. This ground plate is mounted on the chassis by means of a single screw passing thru an insulating grommet in the strip. At one end the filter is grounded to one of the mounting screws of the output coax connector. The purpose of this arrangement is to prevent r.f. current flow through the chassis to reduce the possibility of instability. The success of these measures is verified by the performance of the exciter. While beating the signal against a crystal oscillator, it is possible to tune the output circuit through resonance without any detectable variation in the beat note. The thermal drift is also negligible, less than two k.c. drift occurring in a one-hour run from a cold start. The physical arrangement of the parts is highly recommended for good mechanical stability. Note that a piece of insulating $\frac{1}{4}$ shaft is attached

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to the oscillator tuning condenser and the dial plate is attached to the insulated shaft. This is a further aid in confining the oscillator signal to the oscillator compartment.

The two terminating half-sections in the output filter have coils wound around ceramic condensers. The center coil, the inductance in the pi-section, is wound on a one watt resistor. The photograph of the filter shows how the coils are mounted on the strip, each at an angle of about 60 degrees with the bakelite tie strip for minimum coupling between them. Theoretically, the coupling will be zero if the axis of each coil makes an angle of 54 degrees with a line through the centers of all three coils.

The power supply should deliver 210 volts at 55 ma for the exciter high voltage and 6.3 volts at 1 amp. for filaments. The oscillator frequency is quite sensitive to plate voltage variation, so a regulated supply definitely should be used. A pair of VR 105's in series is adequate.

In constructing the exciter, the coil data must be followed closely to set each coil at the proper inductance. The oscillator and power output plate coils were wound on surplus command receiver coil forms which are not usually available, but other forms may be used with a slight variation of the winding to cover the proper range. A grid-dip oscillator is a most useful piece of equipment for adjusting all the coils, particularly the series resonant coupling coils, L_9 and L_{11} and the coils of the output filter. L_{15} with C_{29} and also L_{17} with C_{32} should resonate at 58 MC, while L_{16} should resonate at 27 MC with 100 mmf.

The front panel of the utility box was replaced with an aluminum panel. The aluminum panel was finished in grey crackle paint, sprayed on with a fly-spray gun, and baked with a bathroom heater for about five minutes.

Performance

An example of the harmonic suppression of the exciter is the fact that on a Hallicrafters Model S-36 signal, on which the 29 MC fundamental frequency signal was 30 db over S-9 on the S-meter, the second harmonic was S2 and the third and fourth harmonics were undetectable although the receiving antenna was one foot from the transmitter load, a 47 ohm resistor.

More careful measurements show that the second harmonic is attenuated 61 db below the carrier and the third harmonic is 55 db below the carrier. Higher frequency harmonic attenuation exceeded the measuring range of the test equipment. The FCC requirements for this class of transmitter are 40 db of attenuation of all spurious radiations. Obviously, the exciter surpasses these requirements by a comfortable margin.

The useful power output is about 1 watt. An amplifier under construction for use with this exciter uses a 6AG7 and a pair of 807's. The output of the exciter may be readily increased to two or three watts by using a 6AQ5 instead of the 6AK6. The plate voltage may then be increased to 250 volts. To compensate for this voltage increase,

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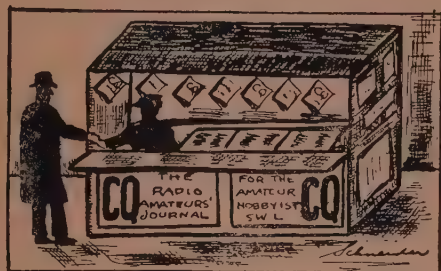
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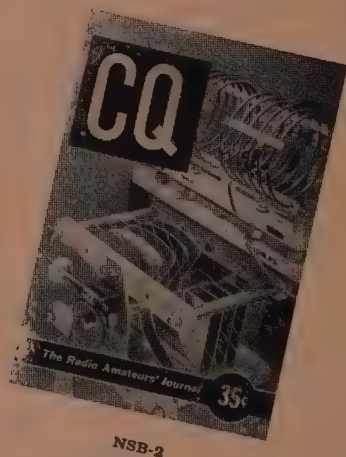
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resistors R_{10} , R_{15} , and R_{19} should be doubled in value. The danger in increasing power output by this change is the aggravation of thermal drift due to increased power consumption and the possibility of self oscillation which always accompanies an increase in voltage gain.

BRASSPOUNDER

(from page 23)

... *45WAC* promises 24-hour return service on traffic to Japan. . . . The emergency boys around St. Louis had a workout when a simulated bombing raid, carried out by planes of the Civil Air Patrol, sent 29 mobile rigs scurrying in all directions between Alton and Tri-Cities in Illinois. The Egyptian RC headquarters was the NCS and 60 club members participated. . . . In Pittsburgh a fire in the telephone company building alerted the emergency gang by a request to *W3OMA* from Red Cross, expressing fear that telephone lines may go out. All hands were on deck, but the fire department kept everything under control. *W3AAK*, *KXU*, *KSP*, and *QPJ* signed in, as did *W3LMM* with his 10-meter net; *W3NCD* maintained NCS on 80. . . . The North Bay ARA announces new officers; *W6ZZF*, pres.; *WXU*, v-pres. and treas. . . . We wonder how true the report is that three hams stole radio gear from the Evanston, Ill., Naval Reserve armory; names were mentioned, but no call letters in the newspaper item reporting the case.

It has been said that amateur radio is "The alleged art of attempting by lethal gadgets to produce a legal signal of questionable importance in distant receivers of similar addicts without blanketing nearby inferior receivers of non-addicts."

... *W2BFD* would like to have some information on those six radioteleprinters reported to be in the Twin Cities in the Minneapolis RC bulletin. . . . Net news comes from the Amateur Transmitters Assn. saying the Western Penna. Net is on 3585 kc at 7 P.M., Monday thru Friday, and the Third Regional Net on 3590 kc at 7:45 and 9:30 P.M. on the same days. . . . The Portland (Oregon) ARC lists its new officers: *W7VT*, pres.; *JNI*, activities mgr.; *NPF*, secy., and the club station is known as *W7KYC*. . . . *W7LCM*, Mayor of Huntley, Mont., continues to add dignitaries to his long list of Dogcatchers, one of the latest being Governor John W. Bonner of his state.

HETERONULL

(from page 26)

tened to the front panel.

After calibration, the device may be used to indicate unknown audio frequencies directly. Simply supply the tuneable amplifier with the audio signal, tune the amplifier until the null is heard, and read the dial. To measure the exact rf frequency or amount of drift of an incoming signal to the receiver, beat the signal to be measured against a known frequency and use the Heteronull to measure the small difference in the two frequencies.

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Extending the frequency range of the bridge is a relatively simple matter. All that need be done is to substitute a new set of resistors of the proper value for each range desired, for the two shown in the circuit diagram (R14, R15) or (R18, R19).

The value of each pair of resistors required for other ranges are shown below:

| Range | Bridge-Resistor Value |
|----------------|------------------------------|
| 50-150 cps | 1.6 ± 5% Megohms |
| 150-500 cps | 580,000 ± 5% ohms |
| 500-1500 | 184,000 ± 5% ohms (R14, R15) |
| 1500-5000 | 80,000 ± 5% ohms (R18, R19) |
| 5000-10000 cps | 24,000 ± 5% ohms |

These additional bridge resistors may be connected in the bridge circuit by means of a suitable switch. A double-deck wafer type, when substituted for the DPDT switch shown in the circuit diagram should do nicely.

DXING

(from page 22)

80). Once the victim has been nailed he is sound out as to conditions on the low-frequency band followed by a request to "listen for mc on 35—". If the baiting operator has chosen his time well and if conditions are at all favorable, the crossband contact generally results. Having thus demonstrated to the DX that it can be done, the actual baiting begins. Sometimes several months pass before the DX station is ready for the try, and the promoter (if he is wise) won't let him cool in the interim. This same system can be worked by a group of operators³ who pepper the DX individual with pleas to "try 80." In promoting 80 meter DX there are three rules to remember: (a) Pick a possible, a favorable time and season and have at least one high-powered station on hand to make initial contact and, perhaps, to act as M.C. (b) Agree on an exact GMT and frequency, and Avoid the Latin American HF BC stations.

Unfortunately, many foreign DX stations do not realize that long-distance communication is possible on 3.5 mc. In order to arouse their curiosity, tell them to listen "on the low end" during the DX hours (0000-1200 GMT depending upon their continent), or for WIAW on 3555 kc. Although it is almost impossible to believe, many DX stations have never LISTENED to 3.5 mc and are surprised to hear W signals come thru on that band.⁴ Tell these stations that many USA and stations make a practice of DXing on 80. In short, do anything possible to work up their interest.

It is good policy to brief the DX station somewhat when promoting him. If he does make a scheduled and conditions turn out to be unfavorable, he never return. This possibility can be minimized somewhat at the outset by advising him to listen for a few nights and note which times seem most appropriate for working your area. Ordinarily it will take the other operator a period to re-

his station for the test and this period can be used by him to gain familiarity with the band. Because of the numerical superiority of W stations he will almost certainly hear some W stations and from that will gain a knowledge of the most favorable times for working a given North American area.

One need not wait until the winter months, either, to begin his promotions. If the other station is located in the opposite hemisphere a fair possibility of success exists at any time since one or the other is bound to be favored by cool weather. Generally North American stations will enjoy the greatest possibility of success during the winter months when receiving conditions are at a peak since they can then break through the other area's atmospheric noise with their higher (average) power.

QSLs

DX stations, with very few exceptions, QSL faithfully and quickly all contacts made on 3.5 mc. This is due to the fact that 80 meter DXing is still somewhat of a novelty to most of them—and they respect the eagerness of the other station to receive a low frequency confirmation. It goes without saying that the W or VE station is duty bound to be equally courteous in this respect. Some stations have made up a special "80 Meter DX" QSL which is used in place of the regular station QSL.

In brief, the 3.5 mc band offers the newcomer a chance to work DX in an uncrowded band, even with low power. It offers the jaded "200-plus" DXer a chance at a second honeymoon—and it offers all of ham radio a chance to relieve some of the congestion on the more popular DX channels. It offers another DX band—what else is there to say?

PROPAGATION

(from page 19)

the hot mass. Weather, however, usually moves from west to east.

An examination of these paths may also explain the skip phenomenon occasionally noted on the two meter band. Station at "A" can work station "B" via simple reflection. "A" can also work station "C" via super refraction; but "B" cannot hear "C" as he is in the refraction skip zone. "B" can work "D" by simple reflection and possibly "A" can also hear "D" via second hop reflection.

An example of this condition occurred on the night of July 23rd, 1949 when W2YT/3 at State College, Pa., 150 miles east of Pittsburgh, was in two meter QSO with W9TKL at Waukegan, Ill. and W9EVL at Appleton, Wisc. W3RUE, an outstanding station in Pittsburgh, Pa., was hearing W2YT/3 and W8WJC at Everett, Ohio S9, but was not hearing the W9s at all.

A similar phenomenon was noted during the wide-spread band opening of September 6, 1950. W3QKI, of Erie, Pa., reported hearing W2BAV, at Claryville, N. Y., working several stations in the W9 and WØ call areas, but apparently all this choice DX was passing right over Erie. This was almost without doubt a tropospheric opening, since W2BAV was hearing signals from the en-

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| XMTR RECTIFIER FILAMENT TYPE | | | | | | | | | |
|------------------------------|----------|------|--------|------------|-------|-------|------|--------|--|
| Type | Sec. | Sec. | Insul. | Dimensions | | | | | |
| No. | Volts | Amp. | Volts | H | W | D | Mtg. | | |
| P-2940 | 2.5 c.t. | 10 | 7500 | 3 | 3 3/8 | 2 1/4 | B | \$3.15 | |
| P-3042 | 2.5 c.t. | 10 | 10000 | 2 7/8 | 3 3/8 | 2 1/4 | EH | \$3.45 | |



B

XMTR FILAMENT FOR MEDIUM AND HIGH POWER POPULAR TUBES

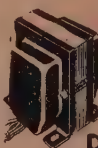
| | | | | | | | | | | |
|---|--------|----------|------|------|------|-------|--------|-------|--------|--------|
|  | P-2943 | 5 | c.t. | 20 | 2500 | 3 3/4 | 3 1/8 | 3 | EV | \$6.00 |
| | P-2947 | 6.3 c.t. | 6 | 2500 | 3 | 3 3/8 | 2 1/4 | B | \$3.00 | |
| | P-3146 | 10 | c.t. | 10 | 3000 | 3 7/8 | 3-3/16 | 3 3/4 | D | \$5.55 |

A

LOW AND MEDIUM POWER PLATES

| Type No. | Sec. Rms. | Sec. DC | DC | Dimensions | | | | | |
|-----------|-----------|---------|--------|------------|---|-------|---|------|--------|
| | Volts | Volts | Volts | Sec. M.A. | H | W | D | Mtg. | |
| (500-550) | (400) | 150 | 3-9/16 | 3 3/8 | 3 | 3 1/8 | 3 | D | \$5.70 |

| Type No. | Sec. Rms. | Sec. DC | DC | Dimensions | | | | | |
|-----------|-----------|---------|-------|------------|-------|-------|-------|------|--------|
| | Volts | Volts | Volts | Sec. M.A. | H | W | D | Mtg. | |
| (900-900) | (750) | 225 | 4 3/4 | 2-13/16 | 5 1/4 | 5 1/4 | 5 1/4 | D | \$9.00 |
| (800-800) | (600) | | | | | | | | |



D

| Type No. | Sec. Rms. | Sec. DC | DC | Dimensions | | | | | |
|-------------|-----------|---------|-------|------------|---|----|---|------|---------|
| | Volts | Volts | Volts | Sec. M.A. | H | W | D | Mtg. | |
| (1450-1450) | (1200) | 300 | 5 3/4 | 6 1/4 | 4 | EH | | | \$22.35 |
| (1175-1175) | (1000) | | | | | | | | |



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ture region from over 1000 miles away to "local-range" ground-wave distances with no apparent gaps in his coverage.

Conclusion

In this series of articles, the author has attempted to explain and define the phenomena of propagation which are used by ionosphere researchers, radar men and meteorologists in terms of simple language that all amateurs can understand and use correctly in discussing v.h.f. propagation.

A summary of the probable propagation paths and media for local and DX communications on the various amateur bands follows:

| Frequency Band | Type of Contact | Probable Means of Propagation |
|----------------|-----------------|---|
| MHF | Local | Ground Wave |
| | DX | Ionosphere (F ₁ , F ₂ , E or Sporadic E) |
| VHF | | |
| 27-30 mc | Local | Ground Wave |
| | DX | Ionosphere (F ₁ , F ₂) |
| | Short-skip DX | Ionosphere (Sporadic E), Aurora |
| 50 mc | Local | Radio line-of-sight, Ground Wave plus Diffraction |
| | DX (Extreme) | Ionosphere (F ₁ , F ₂) (Rare) |
| | DX | Ionosphere (Sporadic E) Tropospheric super-refraction Tropospheric reflections Aurora |
| 144 mc | Local | Radio line-of-sight, Ground Wave plus Diffraction |
| | DX | Tropospheric Super-Refraction and Reflection Ducting possible, but unusual Sporadic E possible, not probable Aurora |
| UHF | Local | Radio line-of-sight, plus Diffraction |
| | DX | Tropospheric Super-Refraction and Reflections Temperature inversion Ducting (Note: The higher the frequency, the greater the possibility of Ducting becomes.) Aurora—? |

In the preceding table, the following definitions apply:

Frequencies from 1.4 to 30 mc—Medium High Frequency, MHF

Frequencies from 30 to 200 mc—Very High Frequency, VHF

Frequencies above 200 mc—Ultra High Frequency, UHF

Acknowledgment

The author wishes to thank Dr. Arthur H. Waynick, Director, Radio Propagation Laboratory, The Pennsylvania State College, for his kindly interest and advice, which have added much to the content of this paper.

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CQ Ad Index

| | |
|--------------------------------------|-----------|
| Allied Radio Corp. | 4 |
| American Phenolic Corp. | 4 |
| Atronic Corp. | 6 |
| Barker & Williamson | 4 |
| Bud Radio, Inc. | 4 |
| Collins Radio Company | 1 |
| Columbia Electronics Sales | 5 |
| Communications Equipment Co. | 6 |
| Concord Radio Corp. | 5 |
| Eitel-McCullough, Inc. | 6 |
| Engineering Associates | 6 |
| Esse Radio Company | 4 |
| General Electric Company (Tube Div.) | 4 |
| Hallicrafters Co. | 8 |
| Harvey Radio Company, Inc. | 5 |
| Hotel Lincoln | 5 |
| Instructograph Company | 5 |
| Johnson, E. F. Co. | 6 |
| Letting Radio Mfg. Co. | 5 |
| Lysco Mfg. Co., Inc. | 5 |
| Merit Transformer Corp. | 6 |
| Millen, James Mfg. Co., Inc. | 5 |
| Motorola, Inc. | 5 |
| National Company, Inc. | 64, Cover |
| Newark Electric Company | 4 |
| Overbrook Company | 6 |
| Petersen Radio Company, Inc. | Cover |
| Premax Products | 5 |
| Radio Amateur Call Book | 6 |
| RCA Tube Dept. | Cover |
| Radio Products Sales, Inc. | 4 |
| Radio Shack, The | 4 |
| Rumph, Dave Co. | 1 |
| Sam's Surplus | 1 |
| Sprague Products Company | 1 |
| Sun Radio of Wash., D.C. | 4 |
| Tab | 1 |
| Trans-World Radio-Television Corp. | 1 |
| Vibroplex Co., Inc. | 1 |
| Weston Laboratories | 1 |
| World Radio Laboratories, Inc. | 1 |

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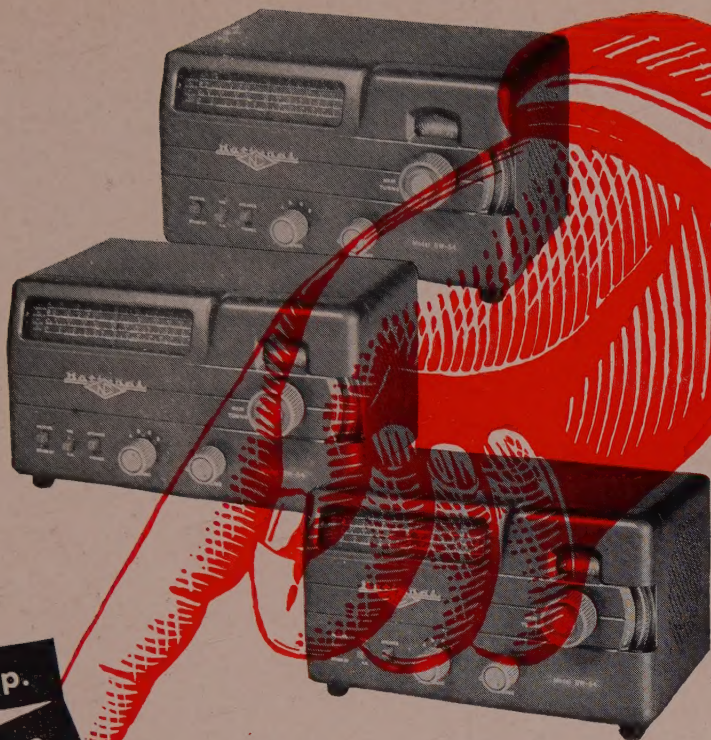
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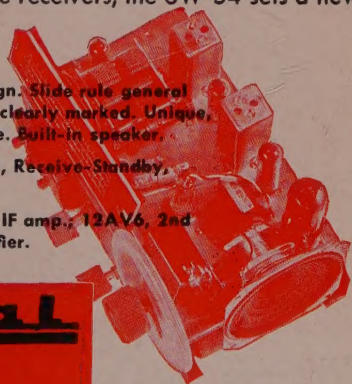
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